

GEOGRAPHY BULLETIN



The
Geography Teachers' Association
of New South Wales Inc.

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DESERTIFICATION: SCIENCE, CONSERVATION, DISCOURSE, NARRATIVES, PARADIGMS AND VISIONS

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GEOGRAPHY BULLETIN

Editors

Dr Grant Kleeman, Macquarie University

Lorraine Chaffer, Gorokan High School

Articles and letters should be sent to the Editor:

Dr Grant Kleeman,

School of Education Macquarie University

Sydney NSW 2109

Email: grant.kleeman@mq.edu.au

Design and layout:

Jill Sillar, Professional Teachers' Council NSW

jill.sillar@ptc.nsw.edu.au

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The
Geography Teachers' Association
of New South Wales Inc.

OFFICE OF THE GEOGRAPHY TEACHERS' ASSOCIATION OF NEW SOUTH WALES

ABN 59246850128

Address: 56 Bland Street, Ashfield NSW 2131

Postal Address: PO Box 577

Leichhardt, NSW, 2040, Australia

Telephone: (02) 9716 0378, Fax: (02) 9564 2342

Website: www.gtansw.org.au

Email: gta.admin@ptc.nsw.edu.au

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Cover: The Sahara Desert, Africa
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The Geography Bulletin is a quarterly journal of the Geography Teachers' Association of New South Wales. The 'Bulletin' embraces those natural and human phenomena which fashion the character of the Earth's surface. In addition to this it sees Geography as incorporating 'issues' which confront the discipline and its students. The Geography Bulletin is designed to serve teachers and students of Geography. The journal has a particular emphasis on the area of the Pacific basin and its near neighbours and a specific role in providing material to help meet the requirements of the Geography syllabuses. As an evolving journal the Geography Bulletin attempts to satisfy the requirements of a broad readership and in so doing improve its service to teachers. Those individuals wishing to contribute to the publication are directed to the 'Advice to contributors' on the preceding page. Articles are submitted to two referees. Any decisions as to the applicability to secondary and/or tertiary education are made by the referees. Authors, it is suggested, should direct articles according to editorial policy.

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Volume 46, No3 2014
EDITOR: Dr Grant Kleeman

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Dr Grant Kleeman, Editor

Editorial

Featured in this edition of the *Geography Bulletin* is the GTA's submission to the Draft K–10 NSW Geography Syllabus and three related articles on deserts and desertification by Nick Hutchinson. In the first of these articles, Nick looks at the process of desertification through a variety of lenses. In his second article Nick looks at *Desertification and Environmental Geography*. Nick's central thesis is that geographers should study human uses and abuses of the environment in order to develop and implement more effective conservation and restoration projects. In his third article Nick examines *Desertification and the Social Sciences*. In doing so, he notes that there are several prevailing 'myths' surrounding desertification. Some are expressed as narratives, some as prevailing discourses. Old paradigms have been defended and new paradigms have been developed about desertification.

Also included in this edition is an article by Susan Caldis – *Assessment for Learning in the Geography Classroom*. In the article Susan poses the question whether we can bring about change to reflect evidence-based practice? Susan concludes that the priorities should be a focus on effective planning and organisation by the teacher and on the importance attached to the provision and quality of feedback. She also notes the need to build AfL culture through the provision of professional development opportunities for staff; the need for importance to be placed on the role and implementation of self and peer assessment; and there is a need for importance to be given to the role of student-centred learning and learner autonomy.

Finally, we showcase a new education program – *FastTracking the Future*. The program provides lessons and resources for primary HSIE and secondary Geography teachers. The secondary materials address key topics covered at Stages 4 and 5 concerning community development and change. Both the primary and secondary lessons offer students the opportunity to explore features of planned change in their local area while developing an understanding of what the North West Rail Link will mean for the people and communities of Sydney's North West region. Lessons focus on building geographical literacy skills, engage students with a wide range of sources and scaffold enquiry-based approaches to teaching and learning.

Coming soon! Discover Barangaroo



Discover Barangaroo is an exciting new interactive educational resource developed by Lend Lease, the Australian construction giant responsible for the redevelopment of Barangaroo South. The site will go live in early 2015 and focus on the urban dynamics of urban decay and renewal, environmental and social sustainability, and liveability.



Barangaroo

Barangaroo is Australia's largest and most ambitious urban renewal project. When complete, more than \$6 billion will have been spent transforming the former container terminal into a vast parkland, a vibrant new entertainment and cultural precinct, and an extension of the city's financial district. More than 23,000 people will work in the precinct and 2,000 will call it home. Millions of Sydneysiders and tourists will visit the area and it will become a focal point for many of Sydney's great celebrations.

Barangaroo also aims to be Australia's first large-scale carbon neutral community and a showcase for environmental and social sustainability.

Barangaroo has three distinct development precincts – the Headland Park at the northern end of the site, Central Barangaroo and Barangaroo South. The 5.7-hectare Headland Park, will host largely recreational and cultural land-uses. Central Barangaroo (5.2 hectares in area) will combine civic and cultural attractions with open space and low-rise commercial and residential land-uses. Barangaroo South will feature high-rise commercial office towers and apartment buildings, a hotel resort complex and a variety of retail outlets, restaurants, cafes and bars.



Barangaroo South

The Barangaroo South development precinct lies at the southern end of the Barangaroo site. At its heart of the precinct will be three office towers to be known as *International Towers Sydney*. The towers will accommodate a new financial and professional services hub for Sydney. The other components of the Barangaroo South include the Crown Hotel and Resort complex, residential apartments, community facilities, retail outlets, restaurants and cafes.



Barangaroo South's International Towers Sydney



Artist's impression – Barangaroo South streetscape



Artist's impression – Barangaroo South's waterfront promenade

Features of the resource

The content of the site is organised into a number of discrete entities. These include:

- An overview of the Barangaroo transformation – its development precincts and features;
- The biophysical environment of Barangaroo – including its location and physical setting and the geomorphology of the Sydney basin;
- Barangaroo's indigenous past;
- The historical geography of Barangaroo and how this reflected changes in the technology of shipping and cargo handling;
- The urban dynamics shaping Sydney with a focus on the impacts of technological, economic and demographic and social change;
- The transformation taking place at Barangaroo South with a focus on the development of the public domain and the commercial elements of the site;
- The strategies pursued to ensure the long-term environmental and social sustainability of the precinct;
- The liveability of cities and how it can be enhanced; and
- The role of Lend Lease in the transformation of Sydney.

Each section of the site includes a diverse range of stimulus material including ground level, oblique and aerial photographs showing change over time; maps; computer generated images indicative of a redeveloped Barangaroo; animated flythroughs; and live webcams and video links.

An activity sheet featuring a comprehensive range of questions and activities, including tasks that promote critical thinking and conceptual enhancement, accompanies each section of the site.

The site's teacher resource includes curriculum mapping for the existing **NSW Geography Syllabus (Stages 4–5 and 6)**, the **NSW Syllabus for the Australian Curriculum – Geography K–10 (Draft)** and the **Australian Curriculum: Geography**. The teacher resource also includes a number of virtual fieldwork activities.

In its totality, the website provides students with an outstanding case study of the processes shaping urban environments.

Dr Grant Kleeman
Editor



The
Geography Teachers' Association
of New South Wales
ABN: 59 246 850 128

**Feedback around the
draft K–10 Geography syllabus for BOSTES.
September 2014**

Submitted by:

Geography Teachers' Association of NSW

PO Box 577

Leichhardt NSW 2040

Tel: +61 2 97160378

Fax: +61 2 95642342

Email: gta.admin@ptc.nsw.edu.au

Draft K–10 Geography syllabus

Introduction

The Geography Teachers' Association of NSW (GTANSW) welcomes the opportunity to provide a response to the Board of Studies Teaching and Educational Standards (BOSTES) draft K-10 Geography syllabus, incorporating Australian Curriculum content. The views expressed in this response encapsulate the considered, researched opinions from the GTANSW Council. The GTANSW Council is comprised of expert Geography teachers from across the Independent, Catholic and Government sectors; tertiary educators and academics; and Geography education consultants.

The response is framed around areas of perceived strengths and suggested areas for further consideration. An overview is provided initially. The overview is followed by deeper analysis of key syllabus areas; and concludes with a response about resources and the proposed timeline.

The GTANSW Council would like to commend the syllabus writing team, reference group and BOSTES officer(s) responsible for the development of this document for their work in producing a quality syllabus that retains the integrity of the original *Foundation to Year 10 Australian Curriculum: Geography* framework, moving NSW school Geography in to a contemporary, world class domain. The draft syllabus provides great potential for educators to develop rigorous, interesting and relevant teaching and learning programs that inspire students' curiosity, awe and wonder about the places that make up our world.

Areas of perceived strength in the draft K–10 Geography syllabus include:

- the clarity and prominence of an inquiry-based approach; and emphasis on the use and implementation of fieldwork (including virtual fieldwork), evidenced in the Rationale (particularly paragraph 3) and throughout the syllabus;
- the clear and consistent reference to the underpinning concepts (conceptual framework);
- the emphasis on the role of Geography contributing to the development of students becoming active and informed citizens;
- the explicit inclusion of spatial technologies as part of the Tools and Skills;
- the very close alignment to the ACARA document - *Foundation to Year 10 Australian Curriculum: Geography*;
- the continuum of learning from K–10 including an appropriate range of key terms and suitable content, and sequenced in a logical manner;
- the icons indicating where an integration between content and the use of tools and skills could and should occur; and
- the hours and status allocated towards the study of Geography across Years K–6 and Years 7–10.

Suggested areas for further consideration in the draft K–10 Geography syllabus include:

- **the need for greater flexibility in response to coverage of proposed content, particularly the dot points**

Whilst the GTANSW Council acknowledges greater specificity via the use of dot points may be required for non-specialist teachers in order for them to accurately interpret the content descriptions, the quantity and length of dot points appear to be excessive if they are all meant to be taught. The opportunity to chunk or select from the content descriptions or the dot points would be beneficial for teachers and provide a balance between the framework developed by ACARA and the traditional, more prescriptive and content driven approach typically adopted by NSW syllabuses.

The GTANSW Council would like to see firstly, a reduced length of individual dot points (perhaps this could be achieved by removing some references to specific places and including a statement at the end of the content description stating 'It is expected that specific examples will be chosen from a range of scales with particular reference to Asia'); and secondly, greater clarity about what is mandatory to teach and also greater frequency in the use of terms including 'such as', or 'could include' to indicate areas of flexibility for teachers, throughout the document. Alternatively, an overarching statement positioned earlier in the document clarifying that there is flexibility in the number of dot points to be covered providing all outcomes are assessed could also be an option for consideration.

- **the need for greater currency and relevance of tools and skills identified throughout the document**

Tools and skills should be more focused towards what is useful now and in the future for our students to become familiar with, use and apply, in order for them to better interpret and understand the world around them. It is our opinion that the list of tools would be considered 'old-school Geography' and therefore, the GTANSW Council question whether how many of the listed tools and skills are really necessary for an understanding of contemporary Geography. The scope for, and emphasis on the use of digital technologies; and the development of questioning, reasoning and higher order thinking skills needs greater prominence. Whilst the GTANSW Council do strongly support the explicit inclusion of spatial technologies already evident in the document, we would like to see the skills scaffolded from lower to higher order thinking throughout the document; and greater frequency in the variety and use of digital technologies, to either support or replace the more traditional and dated skills of items such as constructing climate graphs (the skill lies in their interpretation). We would also like to suggest the understanding of 'spatial technologies' is broadened to include more than hardware and software i.e. including web tools; and also rewrite 'pictures' as 'visual representations'.

- **the need for an improved alignment of the Geographical Concept statements to the glossary**

At times across Stages 4 and 5, the description of place and space in particular seem confused and not well aligned to the Glossary. The GTANSW Council note (and support) that the Glossary included in the draft syllabus is the one found in the *Foundation to Year 10 Australian Curriculum: Geography*. It would appear the syllabus writers have interpreted these concepts without recourse to their meaning in the glossary. The GTANSW Council would, therefore, like to recommend the Glossary is retained in its existing form, particularly for the underpinning concepts. However, we suggest that in order to ensure alignment between the expression of key terms and concepts (particularly place and space) throughout the syllabus content, and the meanings defined in the Glossary, syllabus writers undertake a audit of the Glossary and the manner in which terms are used within the content of the draft syllabus. The GTANSW Council would also like to remind the syllabus writers, reference group and BOSTES team that 'community' is subsumed in a sophisticated understanding of the underpinning concept of place.

- **the need for a more user-friendly layout of the document**

The amount of 'layers' associated with this document is complex and inhibits easy interpretation of the draft syllabus. The GTANSW Council would like to see a more accessible view of the syllabus for each topic, stage and year level in order to enhance the appearance of the document and enable ease of understanding and interpretation about content tools and skills. The return of a 'table' like approach to layout, such as in the current NSW 7–10 Geography Syllabus would provide a more accessible view of the key components in the syllabus of most relevance to teachers.

Key syllabus areas: perceived strengths with suggestions for further consideration:

Rationale and Aims

- **Rationale:** the first paragraph (starting: Geography is a rich and complex discipline...) encapsulates interconnections really well (same in the second paragraph) but the GTANSW Council would like to see wording to reflect 'curiosity about the places that make up our world' incorporated either in to the first or second paragraph. Words of this nature would reflect the rich concept of place (which is more than just location) and also provides a coherent and relevant lead in to the third paragraph. In order to develop an opening sentence with more inspiring words about Geography, something more relevant and meaningful on which to hang our hat as Geography educators, the GTANSW Council would like to propose the writers ask themselves 'what is Geography all about?' and 'why should students study Geography?' This might help to refine a more meaningful purpose to the study of Geography in addition to the opening sentence, although it is not in dispute that Geography is a rich and complex discipline that integrates knowledge from natural science, social science and humanities
- **Rationale:** the second paragraph states 'Geography emphasises the role of the environment in supporting human life form from local to global scales', the GTANSW Council would like to suggest that reference to how humans support and impact on the environment should also be considered for inclusion in this paragraph, or further expansion about interrelationships should occur for clarity about the duality of human-environment connections.
- **Rationale:** the third paragraph (starting: Through an inquiry approach...) is strongly supported by the GTANSW Council. It is an excellent statement that really provides an insight in to the uniqueness of Geography; and brings best practice geographical pedagogy to the fore. It will remind teachers about the key to bringing relevance to the teaching of Geography – which should therefore enhance student engagement with this subject. The GTANSW Council strongly support this paragraph being retained in its existing form.
- **Rationale:** the final paragraph (starting: The study of Geography enables...) is to be commended for its connection to active and informed citizenship, however, as a closing paragraph, the GTANSW Council wonder if the study of Geography is more than this? Without taking away from active and informed citizenship, the GTANSW Council suggests that Geography is also about developing an appreciation and understanding about the diversity of and interconnections between the people and places that make up our world. To that end, whilst we strongly support the intent and much of the wording in this paragraph, we believe the study of Geography enables more than citizenship and would like to see this reflected in the closing paragraph.

Draft K–10 Geography syllabus

Objective and Outcomes

- The GTANSW Council believes overall, the outcomes are appropriately distributed and sequenced across the syllabus, particularly for Stages 4 and 5. However, in the Stage Statements the Stage 4 statements seem to be dominated by higher order terms such as explain and examine. The GTANSW Council would like to propose an adjustment to the first sentence so that it reads 'describe geographical processes' and then build throughout the paragraphs towards the use of higher order terms.
- **Geographical Inquiry (p. 30):** The GTANSW Council strongly supports these statements and would like to see them retained. We believe these paragraphs demonstrate the stages of an inquiry and are both appropriate and manageable whilst retaining the integrity and detail of the inquiry process from the *F–10 Australian Curriculum: Geography* document. However, it is our opinion that through engagement with the inquiry process, students may be motivated to initiate or become involved in some form of action to benefit the world. The GTANSW Council would like to suggest that the inquiry statement could also include clear reference to students being able to do something with the acquired, processed and communicated geographical information, for example, 'Geographical Action'.
- **Fieldwork (p. 31):** The GTANSW Council strongly supports these statements and commends BOSTES for ensuring the emphasis placed upon fieldwork in Geography reflects its importance in maintaining the uniqueness, relevance and best practice pedagogy of Geography education. In the last paragraph (starting: Fieldwork can be undertaken locally...) we would like to suggest that 'site' is rewritten as 'place'; 'place' being more geographical and 'site' having more of a History syllabus connotation (re: site studies). Additionally, 'primary sources' should be rewritten as 'primary data and information'; 'data and information' being more geographical, and 'sources' having a History syllabus connotation, thus potentially leading to confusion.

Content

- The GTANSW Council believe four topics at each stage is manageable and there is suitable progression between Stage 4 to Stage 5. Whilst we acknowledge virtual fieldwork could be used as an argument by schools not to conduct fieldwork activities outside the school, the GTANSW are of the opinion that virtual fieldwork should be retained for reasons of choice, inclusivity and acquisition of technology skills as part of a field experience. Virtual fieldwork also makes it possible for students based in rural and remote NSW settings to more easily undertake urban investigations in cities such as Sydney, and vice-versa.
- The GTANSW Council believes there a small number of repetitions and inconsistencies in content between Years K–6 and 7–10, for example, bushfires and floods appear in both Stage 3 and Stage 4. The GTANSW Council would like to suggest an audit of content and examples at each in order to counteract unnecessary repetition.
- The GTANSW Council acknowledges appropriate and correct use of scale in the continuum from local to global. However, the omission of personal scale is of concern, particularly when international research about the development of Geography curricula emphasise the importance of students understanding their personal geographies ahead of and in the context of similarities and differences with other scalar levels, as well as in the context of civics and citizenship.

***Water in the World* (p. 63–68) – used as an example to demonstrate key points of feedback**

- p. 63 and similar throughout the document – The GTANSW Council supports the content of this page, particularly the statement about fieldwork and prominence of concepts, although sometimes there is a lack of alignment between concept statements and the definitions in the Glossary.
- p. 64 and similar throughout the document – The GTANSW Council strongly supports the inquiry process and its identification as a skill set.
- p. 65 and similar throughout the document – The GTANSW Council questions whether they are only geographical tools? Would 'methods and tools' be a more accurate representation? We would like to see greater emphasis on the digital tools, methods and skills that students would be using (and already use) in their study of Geography to make meaning of the world around them.
- p. 66–68 and similar throughout the document – The GTANSW Council notes that each topic has 5–6 content descriptions, and believe this is manageable (could they be numbered to improve clarity of layout?) but the quantity of dot points underneath is unwieldy and yields a perception of overcrowding. The GTANSW Council would like to propose that consideration be given to including a statement to indicate flexibility either with the number of content descriptions selected (for example, out of the six content descriptions for this topic, teachers are expected to cover at least four content descriptions); or, if all content descriptions are expected learning, could there be a statement to indicate flexibility with the dot points (for example, Students 'could'; or somehow integrate a 'such as'...ahead of the dot points). These indicators of flexibility rather than perceived prescriptiveness will reduce the perception of content overload and enhance the manageability of content, tools and skills thus enabling teachers to better cater for their local context, student interest and contemporary events. Alternatively, flexibility could also be linked to the notion that outcomes can be achieved by selecting a few dot points which are of most relevance and appropriateness to the learning needs of students.

Life Skills

- The GTANSW Council supports this area of the syllabus, understanding that close liaison was achieved with the SPO Special Education in developing the content statements. We do not feel as if we are in a position to comment further other than to commend the integrity of important geographical learning for having been retained.

Resources and proposed timeline

- **Resources:** the GTANSW Council would like to suggest several teaching and learning resources already available and in use around the country in response to implementation of the *F–10 Australian Curriculum: Geography*. It is the belief of the GTANSW Council that these resources will still be appropriate in supporting teachers to develop teaching and learning programs for what will become the NSW K–10 Geography syllabus incorporating Australian Curriculum content:
 - * *GeogSpace* website has been developed by AGTA representatives from around the country and is specifically tied to *F–10 Australian Curriculum: Geography content* – all of which (content descriptions) are retained in the current document for NSW <http://www.geogspace.edu.au/>. The ‘core’ units of *GeogSpace* are designed for use within the classroom; the ‘support’ units of *GeogSpace* are designed for teacher professional learning and upskilling although the support units could be adapted for classroom use.
 - * *ScoopIt sites (associated with the affiliate Geography Teacher Associations) and ABC Splash* have a range of relevant resources to support the *F–10 Australian Curriculum: Geography* content as well. These resources range from videos, articles and inquiry activities to scaffolded lesson plans.
 - * key publishers (for example, Pearson, Jacaranda, Cambridge, Oxford) have all produced texts specifically connected to the *F–10 Australian Curriculum: Geography* and are currently modifying these existing texts to suit the upcoming NSW syllabus.
 - * GTANSW Council is prepared and equipped to fulfil the role of leading teacher professional learning (particularly for primary teachers) around the correct interpretation, use and application of geographical concepts, tools and skills. We would support and welcome an opportunity to work collaboratively with BOSTES in developing and/or reviewing resources to support the NSW K–10 Geography syllabus incorporating Australian Curriculum content.
- **Timeline:** GTANSW Council believes that schools should have the option of trialling the new syllabus in 2016 (or prior to). We recommend this in addition to the usual familiarisation year prior to mandated implementation. By the time NSW teachers are implementing the final NSW K–10 Geography syllabus incorporating Australian Curriculum content, they will be between 12 months to three years behind colleagues in other states and territories (Queensland and Australian Capital Territory schools began implementation during 2013). To have an optional, additional trial timeframe for teachers (even a selected pool) to investigate, develop and deliver teaching and learning programs will provide the necessary critique for usefulness of resources, and could also establish and mentoring or professional learning network. The GTANSW Council would be supportive of any move to bring forward the timeline for trial and mandated implementation.

Draft K–10 Geography syllabus

Conclusion

Overall, it is the view of the GTANSW Council that the draft K–10 Geography syllabus incorporating Australian Curriculum content brings NSW school Geography in to the 21st Century and enables best practice geographical pedagogy to be brought to the forefront of our teaching and learning for this subject. The content is interesting, relevant and provides a balance of breadth and depth. The extent to which this draft syllabus maintains the integrity of the ACARA document is to be commended; and the way in which those responsible for the development of this document have embraced the conceptual framework, inquiry approach and emphasis on fieldwork, together with indicating opportunities for the integration and application of tools and skills to content is also to be commended. As Geography educators and resource developers, the GTANSW Council look forward to the implementation of this syllabus and once again would like to congratulate the writing team, reference group and Senior Project Officer Geography for their work in developing a quality document.

Thank you for the opportunity to provide feedback.

Susan Caldis
President GTANSW,
on behalf of the GTANSW Council.

DESERTIFICATION

‘The desert always menaces’ Desertification: science, conservation, discourse, narratives, paradigms and visions

Nick Hutchinson

Introduction

The quotation (Aubréville, 1949, p. 331, cited in Glantz, 2005, p. 323) comes from French forester Auguste Aubréville who was concerned that the African savanna woodlands would be turned into desert like conditions as a consequence of deforestation and subsequent cultivation.

The intention is to build on the notion that ‘Geography integrates knowledge from the natural sciences, social sciences and humanities to build a holistic understanding of the world’ (ACARA, ND). The discussion is applicable to the Year 10 Unit 1, Environmental change and management and the Senior Secondary Curriculum Unit 3, Land cover transformations.

There are more than one hundred published definitions of desertification that have appeared in the literature (Thomas, 1997, 585). Many of them carried the connotation of disaster (Dregne, 1987, 8) but even if most geographers and others working in this field accept the United Nations Convention to Combat Desertification definition of desertification, in effect the dispersed, patch-like degradation of land in arid, semi-arid, and dry sub-humid areas (Grainger, Stafford Smith, Glenn, & Squires, 2000, 365), there is widespread recognition of its complexity. It has been described as a phenomenon revealed by drought, seemingly caused by people, made worse by socioeconomic or biophysical factors, made manifest through vegetation or soil loss and perhaps exhibiting irreversible destruction of the biological potential and diminished abilities to support people and their livelihoods (Mainguet, 1991, 4).

It has also been described as ever expanding desert wastelands (Carlson, 2013), expanding desert – an urgent problem (Reynolds & Stafford Smith, 2002, 7), a living environment becoming sterile and barren (Nicholson, Tucker & Ba, 1998, 815) or, more graphically of all, referred

to in: *China’s Growing Deserts Are Suffocating Korea* (French, 2002) and *Chile: President Piñera Says Desert Growing ‘A Metre Per Day’* (Depsky, 2013).

An examination of desertification through the lens of physical geographers, environmental geographers and those that sit more comfortably in the social sciences and humanities help to unravel this conundrum. Much of the evidence comes from the Sahel but other case studies are alluded to.

Desertification and biogeophysical feedback

The inspirational text for this discussion of desertification is titled *Geography and the Enlightenment* (Livingstone & Withers, 1999), a text that examines Geography’s place within this historical period. Influences of the Enlightenment on geographical thinking included both a predilection for rational knowledge and the rise of science as both a technique and worldview (Livingstone & Withers, 1999, 5). It encompassed an engagement with colonialism (12) that developed distinctive ideas about geography - particular ideas and practices, conceptions of truth and notions of reason, unearthed through exploration, revealed through accumulated data and demonstrated through cartographic techniques. The rationalised structures of thinking of 17thc and 18thc Europe preceded what Peet (1998, 9) termed modern geographical thought.

One strong element of geographical thought that emerged in the middle of the last century was a geography that could integrate physical and human geography through nomothetic science, that is science that emphasises law-giving and explanation, as opposed to idiographic science that privileged description (Hubbard, Kitchin, Bartley & Fuller, 2002, 13). Geography as nomothetic science, infused with the ideas of positivism, adopted processes of inference, observation, deduction and, cause and effect (28). And, the genesis of positivist science lies in the Enlightenment. Enlightenment thinking processes can be traced through to key themes that permeate physical geography today, 'the search for universality in explanation, the study of stability and change in the physical environment, and the primacy of empirical information to study the environment' (Inkpen, 2005, 24).

The biogeophysical feedback hypothesis

An explanation for the prolonged drought in the African Sahel in the 1970s and 1980s, the *biogeophysical feedback hypothesis*, was set out in what has been termed a classic paper by climatologist Sharon Nicholson and her colleagues (Nicholson, Tucker & Ba, 1998, 815). The paper, by meteorologist Jule Charney and others (Charney, Stone, & Quirk, 1975), speculated that albedo changes resulting from overgrazing and degradation had resulted in a highly reflective surface and had produced a decline in rainfall across the Sahel. In simple terms the vegetation cover was reduced during the drought years and this situation was exacerbated by overexploitation by humans and animals. This, in turn, initiated a positive feedback loop through higher albedo values (the proportion of sunlight that is reflected back into the atmosphere rather than absorbed by the soil). Higher levels of reflectivity lead to less heat absorption at ground level with fewer thermal currents ascending to form rain-bearing clouds. As a consequence, there is less rain, leading to further exploitation, an extension of the desert in a self-aggravating process (Linacre & Hobbs, 1977, 20).

The biogeophysical feedback mechanism, as expressed in the Charney article, claimed that the 1970s Sahel drought was as result of desertification and when the UN proclaimed that some 35 million km² of land had been lost (Nicholson, Turner & Ba, 1998, 818) a powerful discourse of desertification was unleashed in scientific, political and institutional circles.

A number of scientists led by geographer Alan Grainger, including Mark Stafford Smith, a CSIRO scientist based in Alice Springs, Victor Squires, a dryland management consultant from South Australia, and Edward Glenn, an environmental scientist from Arizona concluded in 2000 that 'there was no conclusive proof of this



Approaching dust storm, Arizona. Source: Wikimedia Commons

[the biogeophysical feedback mechanism], nor of other suggestions that the drought was caused by global climate change, and variation in sea-surface temperatures seemed to offer a more convincing explanation (Grainger, Stafford Smith, Glenn & Squires, 2000, 370).

Arizona-based arid lands scientists, Charles Hutchinson and Stefanie Herrmann pointed out that the 'relationships between climate and land degradation in drylands are much more complex and less well understood than initially assumed' (2008, 66). There could be local effects of increasing albedo. Biologist Uriel Safriel and environmental engineer Zafar Adeel (2005, 631) explained that albedo might also increase locally following dust storms. These dust storms are initiated after the removal of vegetation. But, again Hutchinson and Herrmann (2008, 66) assert that there are major uncertainties revolving around the roles of surface albedo and atmospheric dust.

The initial biogeophysical feedback mechanism hypothesis argued that desertification actually contributes to drought, and not vice versa (Herrman & Hutchinson, 2005, 1). The original proposal stemmed from work by Joseph Otterman (1974), an environmental scientist from Tel-Aviv University 'citing the example of the Sinai-Negev region, where the denudation of bright sandy soil by grazing on the Egyptian side increased albedo and decreased surface temperature compared to the more densely vegetated Negev side' (Herrmann & Hutchinson, 2005, 540). However, it was Charney and his colleagues that scaled up the hypothesis using Global Circulation Model experiments to postulate increased albedo could enhance large scale atmospheric subsidence in high pressure cells located above deserts and thus, increase desiccation. In the General Circulation Model experiments, using atmospheric models developed at the Goddard Institute of Space Studies, albedo was increased over several semi arid regions, including the Sahel. The results indicted a significant

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reduction in rainfall and a southward shift of the heat equator, the inter-tropical convergence zone. 'These studies generally concluded that a positive feedback exists, with such changes reducing rainfall and thereby further altering the vegetation and soil and promoting desertification' (Nicholson, Tucker & Ba, 1998, 819)

When satellite measurements of actual sub-Saharan albedo were gathered there was no evidence to indicate a pronounced and prolonged increase in albedo, or, at least, one that would produce significant differences in rainfall (Herrmann & Hutchinson, 2005, 540). Any such effects were local rather than trans continental and occurred over short periods of time rather than sustained episodes, both of which would be prerequisites for the Global Circulation Model to operate.

In short, the empirical evidence for the biogeophysical feedback mechanism did not support the modelling hypothesis. To illustrate some of the complexities involved in using finer scale studies to then generate an hypothesis a number of empirical studies can be examined. In North America, surface temperatures in the Sonora were generally 2° to 4°C higher on the brighter, more heavily grazed Mexican side of the border than on the U.S. side (Nicholson, Tucker & Ba, 1998, 821). The less heavily grazed areas on the U.S. side of the border did show increased soil moisture and cloudiness, but no changes in rainfall (821). Although case studies at a coarser scale indirectly support the idea that desertification can at least potentially have an influence on weather and climate (821). Grainger and his co-authors conclude that, 'The present consensus, based on empirical and modelling studies, is that the main impacts of desertification on climate are at local and regional levels' (Grainger, Stafford Smith, Squires & Glenn, 2000, 370). Geographers Simon Batterbury and

Andrew Warren (2001a, 3527) support this conclusion, 'Current research provides strong evidence that changes in surface characteristics, including vegetation, affect local and regional rainfall patterns significantly.' But they implacably assert that the biogeophysical feedback mechanism at a macro scale 'remains disputed' (3527).

Nicholson and her colleagues had conducted a sixteen yearlong study between 1980 and 1995. Their analysis clearly demonstrated that the extent of the Sahara Desert and the Sahel fluctuated every year according to variations in annual rainfall totals. There was, 'No progressive change in either the desert boundary or the vegetation cover in the Sahel is evident during the 1980–95 analysis period' (1998, 827). Similarly, the year-to-year variations in surface albedo were small in comparison to the albedo changes described by Charney and colleagues. They pointed to complexities in the recovery of vegetation patterns after dry periods and the interactions between plant species and grazing animals. They concluded, 'These earlier papers used crude representations of the biosphere and somewhat unrealistic changes of surface conditions' (Nicholson, Tucker & Ba, 1998, 820). Nicholson (2011, 443) explains, 'Field observations, aerial and satellite photos, and vegetation information all show that the albedo changes that occur are much smaller than Charney's theory requires and that they are inconsistent with changes in rainfall and vegetation that occur.' Nevertheless, despite the absence of supporting empirical evidence for the Charney hypothesis, (Herrman & Hutchinson, 2006, 20) the modelling studies help us to understand the interrelationships between land surface and atmospheric processes.

A simple interconnection between increased albedo and desertification is much more complex than was originally assumed.

Below: Senora Desert Museum, Arizona. Source: Wikimedia Commons



Desertification and environmental geography

The seminal text for this section is Andrew Goudie's *The Human Impact on the Natural Environment* (1986). It encompasses one of the four traditions of Geography as expressed by Pattison (1964), namely the man-land tradition, 'one of the pillars of the discipline since the modern academic structure crystallised in 19th-century Germany' (Mosley et al 2014, 7). The others pillars being the spatial tradition, area studies tradition and earth science tradition (Pattison, 1964). Goudie traces the impact of humanity on Earth through the development of geographical thought which included George Perkins Marsh' *Man and Nature* (1864) and then mentions a number of Geography texts including *Man's Impact on the Environment* (Detwyler, 1971), *Environment and Man* (Wagner, 1974), *Man and Environmental Processes* (Gregory & Walling, 1979) and *Biogeography: natural and cultural* (Simmons, 1979).

However, the focus in this section is expressed more precisely by geographer Bill Adams, through his book *Future Nature* (1996) that argues that 'geographers should study human uses and abuses of the environment so as to fashion more effective conservation and restoration projects- effective because they are based on accurate understanding' (Castree, 2005, 178).

Goudie (1986, 46) explained that the debate about the question of the alleged expansion of deserts was keenly contested and highly contentious and yet geomorphologist, Geoff Pickup maintains that, in Australia, we rarely use the term, preferring to refer to land degradation (1998, 52). However, the locus of much of the discussion about desertification is Africa, in part because the newly established UNEP in the 1970s, with its headquarters in Nairobi, Kenya. The UNEP proclaimed desertification as the greatest single

environmental threat to the future well-being of the Earth (Benjaminsen & Berge, 2005, 48). The debate was also circumstantial, because of savage 1970s droughts in the Sudano-Sahel region that resulted in 250 000 deaths, millions destitute and pronounced rural-urban migration. Furthermore, in Ethiopia, 1982-1986, the combined effects of severe droughts and civil war killed over a million people (Reynolds & Stafford Smith, 2002, 6).

Accurate understanding of desertification

Accurate understanding is essential. As recently as 2007 the UNEP still referred to the spread of the Sahara Desert across the northern half of Sudan as a 50 to 200 km southward shift of the boundary between desert and semi-desert occurring since rainfall and vegetation records began in the 1930s. Their source for this assertion was some very old geographical research (Stebbing, 1935). They did add the caveat that the evidence for the findings is piecemeal, anecdotal and/or based on site-specific data (UNEP, 2007, 64).

Much earlier a United Nations Food and Agriculture Organisation graphic maintained that, 'On the southern edge of the Sahara, an area the size of Somalia has become desert over the past 50 years. The same fate now threatens more than one third of the African continent. The main cause of desertification is not drought but mismanagement of land, including overgrazing and felling of trees and brushwood for fuel' (FAO, 1990).

Nick Middleton (1991, 6) explained that terms such as: desert encroachment, desert advance, desert creep, desert expansion, and spreading deserts all suggest that desertification involves the expansion of existing deserts at their edges. But David Thomas was adamant, 'the concept of an advancing desert front used to infer desertification and the spread of the Sahara is incorrect' (Thomas, 1993, 323). Indeed, a more recent assessment from the United Nations Convention to Combat Desertification (Kirby & Landmark, 2012, 12) stated that

'Contrary to popular perception, desertification is not the loss of land to desert or through sand-dune movement. Desertification refers to land degradation in arid, semi-arid and sub-humid areas resulting from various factors, including climatic variations and human activities.'



Left: Somaliland drought, East Africa. Source: Wikimedia Commons



*Drought conditions, Lake Hume, on the Murray River system.
Source: Wikimedia Commons*

The process of land degradation

The next step is to understand the process of land degradation. Alan Grainger (1990, 7) put it so succinctly enough, 'desertification is the degradation of lands in dry areas'. And, there is plenty of evidence of environmental degradation from the Australian context, for example, 'European agriculturalists in just five generations have altered the face of the Australian continent far more dramatically than had been done by all those who had gone before' (Graetz, Fisher & Wilson, 1992). In the 1980s Australian geographer John Holmes observed that, 'The cumulative effect of vegetation loss, gullying, scalding and sand drift can be termed 'desertification', or the transformation of semi arid ecosystems into desert' (Holmes, 1983, 51). But later most Australian geographers focused on accelerated land degradation in drylands. Geographers Arthur and Jeanette Conacher (Conacher, 2006, 1) defined land degradation as 'alterations to all aspects of the biophysical environment by human actions to the detriment of vegetation, soils, landforms, water, ecosystems and human wellbeing.'

Pickup (1998, 52) adds, also, that here is little contention about the causes of Australian rangeland degradation. He identifies unsuitable land use or poor land management. Although the triggering mechanism could be both unusually wet and unusually dry conditions, situations made worse by the roles of feral animals, especially the rabbit in the southern part of the continent.

More generally arid lands scientist Howard Dregne explains, that here are two classes of causes of land degradation in the world's drylands. The direct cause reflects Pickup's observations regarding poor land management but the indirect causes are more intractable and far more difficult to redress. 'The indirect causes of the mismanagement may be many: land

tenure arrangements, export-import policies, political acts, drought, poverty, poor advisory services, little or no problem-solving research, population pressures, etc. Combating desertification and developing a sustainable management program depends upon removing both kinds of causes' (Dregne, 1999, 100).

What to conserve and restore?

Next, we should be clear about what we wish to conserve and restore. Degraded drylands continue to function as ecosystems but have a reduced capacity to provide ecosystem services: 'have a reduced capacity to supply the goods and services we are seeking, for example, food, habitat for threatened species and landscape amenity' (Lumb, 2012, 1). The United Nations Convention to Combat Desertification couches conservation and restoration in extremely general terms with references to combatting desertification as part of an integrated development objective that incorporates sustainable development in attempts prevent or reduce land degradation, rehabilitate partially degraded land and reclaim 'desertified land' (UNCCD, 1994, 4)

But, more importantly we should appreciate that the basis for an, 'accurate understanding' has deepened, Geographical research into the links between climate, management and degradation has taught us a great deal since the 1970s. Since then, there have been many detailed studies of human impacts on the natural environment. Particularly, those carried out at the local scale in drylands informed by advances in climatology, the soil biological sciences, spatial technologies, agronomy, and the social sciences (Batterbury & Warren, 2001a, 3527). The Millennium Ecosystem Assessment of dryland ecosystems has also contributed to improved understanding of the biophysical and socioeconomic factors that underpin land degradation in arid, semi arid and dry sub humid ecosystems (UNCCD, 2007, 8).

Where dryland degradation takes place

It is important to establish where dryland degradation takes place. The area prone to 'desertification' as opposed to land degradation in general is usually associated with the arid and semi-arid rangelands in Australia although Pickup (1998, 52) explains that it would extend well into the croplands if the climatic definition in the 1994 United Nations Convention to Combat Desertification were used (52). The Convention to Combat Desertification refers to land degradation in arid, semi-arid and dry sub-humid areas in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65. This follows the findings expressed in the *World*

Atlas of Desertification (Middleton and Thomas 1992) that defined drylands as areas with an aridity index value of less than 0.65. When the potential evaporation rate is greater than annual precipitation, this ratio is less than 1. Hyper-arid climate zones have P/PE ratios of less than 0.05, arid 0.05 to 0.20, semi-arid 0.21–0.50, and, dry sub-humid 0.51 to 0.65 (Reynolds & Stafford Smith, 2002). Interestingly, hyper-arid areas are not part of this analysis. They are deemed to be deserts already!

The extent of desertification

The extent of desertification is paramount if accurate understanding is to be achieved. The United Nations Conference on Desertification, held in Nairobi in 1977 resulted in a burst of publicity and much controversy among the geographic and wider scientific community. There were a number of alarmist claims forthcoming. The newly established UNEP was prone hyperbole with ‘at least one third of the present global deserts are man-made, [...], the result of human misuse of the land’ (UNEP, 1991) and some ten years after the conference the UNEP estimated that in a little less than 200 years at the then current rate of desertification, ‘there will not be a single fully productive hectare of land on earth’ (Scoging, 1991, 58).

On the other hand, fieldwork evidence indicated that there was no uniform land degradation and that agricultural production actually increased in places that were designated as being subject to desertification (Herrman & Hutchinson, 2005, 539). Geographer Michael Mortimore, for example, wrote *Adapting to Drought* (1989) examining first hand a 25-year long time period that covered the Sahel famines and droughts in the 1970s and 1980s concluding that African smallholders adapted more or less successfully to climate change and ‘desertification’. Geographer Bill Adams Michael Mortimore discussed land degradation management measures in four farming villages in northeast Nigeria. (Mortimore & Adams, 2001). They described the farmer’s technical expertise in adapting to erratic rainfall, their selection of numerous seed varieties of millet and sorghum that suited local conditions, and husbandry of livestock where ‘everyone owns, or aspires to own, livestock’ (2001, 54). More surprisingly they demonstrated that increasing population densities resulted in better land use rather than accelerated land degradation. They also established that farmers were most adept at adopting ways and means of diversifying their livelihoods in times of stress.

Another text *More people, Less Erosion: Environmental Recovery in Kenya* (Tiffen, Mortimore & Gichuki, 1994), a study conducted over sixty years, concluded that previously degraded land in the semi-arid Machakos



Drought conditions in Ethiopia. Wikimedia Commons

Hills benefited from human ingenuity ‘through a fundamental transformation in farming practices, including: a reversal of erosion thanks to thousands of kilometres of farm terraces and field drains; improved productivity through integrated crop–livestock production systems; new or adapted farm technologies; increased labour inputs; and increased private investments, which were financed in part through off-farm incomes’ (Dobie & Goumandakoye, 2007, 14). Local farmers and land managers were improving biodiversity and halting land degradation without expensive external solutions and inappropriate technological interventions.

Michael Mortimore now has his work published in United Nations documents such as *Why invest in drylands* (Mortimore, 2004), is cited in the UNEP Report, *Global Environment Outlook, GEO4, environment for development* (UNEP, 2007) and acknowledged as a critical expert in the UNDP’s *The Global Drylands Imperative* (Dobie & Goumandakoye, 2007). The United Nations Millennium Ecosystem Assessment Report on desertification (Millennium Ecosystem Assessment, 2005) and the more detailed treatment in (Safriel, & Adeel, 2005, 623–680) are now much more circumspect about the extent of desertification and the active roles of local land managers in redressing land degradation problems.

Moreover, the extent of desertification is made ever more difficult by fluctuations in the boundaries of the Sahel. Mortimore and Turner (2005, 590) remarked on the ‘greening’ of the Sahel seen from space during the period 1982–2002. They were not sure how much of this ‘greening’ was attributable to rainfall effects and how much to more sustainable management practices? But, they did explain that they had documented many ‘success stories’ of environmental management carried

out by smallholders in African drylands, local case studies undertaken in selected districts of Burkina Faso, Senegal, Niger, Nigeria and Kenya.

The Millennium Ecosystem Assessment report, sponsored by private foundations, the Global Environment Facility, the United Nations Foundation and The World Bank, is based on information generated by 1,300 experts from 95 countries over a four year time period. The collective judgements of the authors are couched in the following terms: **very certain** (98% or greater probability), **high certainty** (85–98% probability), **medium certainty** (65–85% probability), **low certainty** (52–65% probability), and **very uncertain** (50–52% probability) (Millennium Ecosystem Assessment, 2005, iv). They say that estimates of the geographical extent of desertification will vary according to the calculation methods and on the type of land degradation included in the estimate (2005, 7). There have been three assessments of the worldwide extent of desertification:

- the Global Assessment of Soil Degradation, (Oldeman, Hakkeling, & Sombroek, 1991), that reported that 20% of the drylands were suffering from human-induced soil degradation, depended entirely on expert opinion exclusive of remote-sensing and field studies;
- Another estimate from the early 1990s, (Dregne & Chou, 1992) based primarily on secondary sources, reported 70% of drylands (excluding hyper-arid areas) were suffering from desertification in terms of soil and or vegetation degradation; and
- A partial-coverage Millennium Ecosystem Assessment (Lepers, 2003), developed as a desk study from partly overlapping regional data sets and remote sensing data, estimated that 10% of global drylands (this time, including hyper-arid areas) were degraded.

The Millennium Ecosystem Assessment Report concluded that the actual extent of area subject to desertification might lie between the figures reported

by GLASOD in 1991 and the 2003 study. This implies, according to the Millennium Ecosystem Assessment Report, that there is **medium certainty** that some 10–20% of the drylands are suffering from one or more forms of land degradation (Safriel, & Adeel, 2005, 637).

Further intelligence about the extent of land degradation in drylands will come from combining an analysis of satellite data with ‘ground-truthing’. As Warren and Khogali (1992) explained, it is a relatively simple task to assess degradation in individual paddocks, but another matter to do so for whole countries and continents. Planners and agencies such as the UN require data at this coarse scale (Thomas, 1993, 324).

More usefully though, data obtained at a more local scale enables East African pastoralists make informed decisions about stocking rates and the movement of animals from place to place. They gain information from satellite-based weather monitoring systems, and associated geospatial technologies to inform them about standing crops and forage conditions. They can make proactive decisions on the basis of short-term weather changes extending over a number of days and longer-term predictions extending over months. Over this longer term period they can make informed decisions about predicted drought before the spectre of ‘desertification’ takes over. They can effectively consider their marketing or management options (Stuth, Kaitho, Angerer, & Jama, 2003, 106).

The ‘greening’ referred by Mortimore above is devised from an index. Earth-observing instruments carried on satellites map differences in NDVI, albedo and surface temperature. NDVI measures the amount of solar radiation absorbed by the vegetation and spatial scientists are able to estimate rates of net primary production from these data. The ‘greenness index’, the normalized difference between difference vegetation index, (NDVI), showed a strong increase in values from 1982–1999 (Mortimore, 2004, 29). Nicholson and her colleagues examined fluctuations in the greenness index across the Sahel (Nicholson Tucker, & Ba, 1998) to explain that the findings were caused by rainfall fluctuations rather than desertification. But there were a number of uncertainties expressed over these conclusions.

To what extent had the efforts of local land managers contributed to this ‘greening’? There is some evidence from Niger to suggest that the popularity of trees on farms, discussed in the section below, have led to a reforested landscape whereas across the border in



Left: Stock losses during drought, Horn of Africa. Wikimedia Commons

Nigeria satellite images depicted a barren landscape. Chris Reij, an agroforestry specialist at the Free University of Amsterdam, remarked that the images depicted the same landscape, same people and same culture (Bilger, 2011). The only difference was the efficacy of tree planting efforts on farms in Niger.

It may be more feasible to examine desertification on a national scale using remote sensing? A desertification map of Zimbabwe was composed using values determined from the French SPOT satellite, between 1998 and 2002. The net primary production of each satellite grid square, or 1sq. km. pixel, was calculated. Grey or white shaded areas on the *Local Net Primary Production Scaling Map of Zimbabwe* appeared to indicate terrain experiencing desertification, with dark grey shading depicting the most 'green' grid squares, or near potential productivity levels. When comparisons were made with land use maps the communal farms tended to match with lighter shaded pixels and the commercial farms darker shading (Safriel, & Adeel, 2005, 638-9). The communal farms support high population densities and are known to be degraded as a result of fieldwork surveys on the ground. It should be stressed that there is a correlation between desertification and elevated population density but this does not imply a causal relationship. The work of Mary Tiffen, Michael Mortimore and others referred to above suggest exactly the opposite may be the case. Poverty may be the crucial factor in this instance? The formerly 'white'-owned commercial farms occupied the better soils and most amenable terrain.

'Green belts' or 'trees on farms'

Batterbury and Warren (2001a, 3528) explained that academic research papers, government policies and interventions are strongly linked. They said that when scientists foregrounded advancing deserts, the policy response was to plant green belts. In the United States, after the Dust Bowl years, a study was drawn up for the establishment of a colossal green belt stretching from Texas to North Dakota. Edward Stebbing, in *The Encroaching Sahara, the Threat to the West African Colonies* (1935) recommended the same sort of scheme for Africa, and the United Nations Convention to Combat Desertification subsequently proposed a green belt across the Sahara, with the New York Times reporting on plans for the revival of a green belt across the Sahara in 1977 (Veron, Paruelo, & Oesterheld, 2006, 753). 'Where scientists believed that herdsmen or farmers were irrationally causing degradation, policy-makers and government officials prohibited goats, tree cutting or grass burning, and destocked herds,

or, on a much more massive scale, they enforced soil conservation programs' (Batterbury & Warren, 2001a, 3528) such as green belts.

In Australia, Matthew Tonts and his colleagues (cited in Conacher, 2006, 13-14) examined a range of socioeconomic as well as environmental consequences of extensive tree planting on land previously used for agriculture in two Australian regions. Ostensibly a solution to redress problems caused by dryland salinity, they were actually export wood-chipping projects in disguise. The plantations contributed to rural population decline and set in train a suite of potential biophysical problems:

- destruction of remnant vegetation and wildlife habitats;
- demolition of conservation works on farms turned over to plantations;
- impact of chemical sprays on water courses;
- hydrological and environmental implications of the draw-down of groundwater aquifers;
- reduced biodiversity associated with single species plantations;
- little attention to weed control;
- soil erosion following timber harvests; and
- water and nutrient depletion from adjacent soils.

Elsewhere, the United Nations Convention to Combat Desertification provides examples of tree planting projects that are deemed to be successful. In Niger between 1975 and 2003 200 million trees were planted in more than five million hectares of land in the Sahel (Kirby & Landmark, 2012 49). But, it is more effective to think of these as tree planting projects rather than 'green walls'. Paul Harrison wrote about the potential success of such projects in 1987. In *The Greening of Africa* he listed numerous small scale innovations including stone lines, planted bunds, grassed strips, water harvesting, alley cropping and hand dug wells at dispersed watering points. In alley cropping, for example, 'food crops are grown between pruned hedgerows of fast growing, nitrogen-fixing trees. The leaves are used as mulch, and act as free fertiliser, improving soil structure and boosting crop yields by upwards of 35%' (Harrison, 1987, 192).

Desertification may be an appropriate term for land degradation of drylands at a national, continental or global scale but land degradation is a much more apposite term at finer scales. At the household, farm or local scale it becomes increasingly apparent what needs

to be conserved and restored. The combination of forestry, cultivation, and livestock rearing is regarded as a sustainable land use option for farmers in the Sahel.

Such practices are built on traditional land use systems and practices, for example, the use of small planting pits or *zai*. The 30cm wide and 20 cm manure filled deep pits funnelled water and nutrients to millet and sorghum crops grown in the Yatenga region of Burkina Faso. The resulting yields were so impressive that neighbouring farmers adopted the technique. NGOs spread the news of this innovation as well introducing the notion of stone lines built along the contours of the fields, which reduced erosion and protected the *zai* (Hutchinson & Herrmann, 2008, 151). A further emphasis on trees on farms improved the soil, conserved water and yielded fuelwood, timber and fodder supplies. The grazing animals are introduced to the fields in the dry season to feed off the stubble and add fertiliser to the fields.

Mary Tiffen and Michael Mortimore (2002, 218) that there have been some positive trends emerging from long-term data obtained from the Sudano-Sahel. They point to case studies from Makueni, Kenya; Diourbel, Senegal; Maradi, Niger; and the Kano zone of northern Nigeria that demonstrate how adaptive small farmers are in maintaining fertility, conserving water, managing trees, increase livestock numbers, and taking advantage of changing market conditions. They explain that the farmers' efforts are all too often constrained by poverty and call upon provincial and national governments to improve market access and increase the scope of non-farm opportunities in efforts to cope with variable rainfall and the reoccurrence of drought. They concluded, 'The 21st Century will see more droughts in sub-Saharan Africa, but neither desertification nor a downward poverty spiral are inevitable' (2002, 232).

Batterbury and Warren (2001a, 3528) explained that, in Niger, authoritarian governments fully embraced green belt proposals despite the reservations expressed by local landholders and current views expressed by many scientists that the schemes were 'deeply irrational'. Similarly, in Mali military rulers banned burning off practices, practices that local pastoralists knew that enriched savanna grassland pastures. On the other hand, the restoration of savanna woodland, in the form of farmed parkland has been very effective. 'In the Maradi Department of Niger, there was rapid conversion of dry forest to farmland from the 1920s until the 1970s, along with in-migration and rapid population growth. Farmed parkland, however, is now well established on permanent fields especially close to the villages. In

fact, the practice of protecting and nurturing valuable seedlings is widely popular and also supported by government policy' (Dobie & Goumandakoye, 2007, 28).

The United Nations Convention to Combat Desertification reported that farmers in Niger suffered 'less from dust storms compared with 20 years ago and that early in the rainy season the current tree densities protect their crops better against the impact of strong winds' (Kirby & Landmark, 2012, 49). When famine occurred in 2005 the villages with trees coped with the sale of firewood and fodder; when the rains arrived late in 2007 the farmers with many trees in their fields benefited from better harvests than those areas with fewer trees (Kirby & Landmark, 2012 49). Silviculture, agriculture and pastoralism are clearly compatible and complementary but this is very different from the erection of immense green belt of trees.

Nevertheless, the United Nations Convention to Combat Desertification refers to the 'Great Green Wall in China' as an example of best practice. Some of the 'advancing desert' rhetoric is still evident in this context where the 'livelihoods of 400 million people are either threatened or affected by desertification, land degradation, the encroachment of the Gobi, Taklimakan and Kumtag Deserts as well as other deserts and sandy lands in western China' (Kirby & Landmark, 2012, 16). To reverse this kind of land degradation the Great Green Wall of trees shrubs and grasses has been planted since 1978. The Chinese government reported in 2011, in '*A Bulletin of Status Quo of Desertification and Sandification in China*' that the degradation of huge swathes of desertification-prone land had been reversed (2012, 16).

Chinese academics are also open to hyperbole, 'Desertification plagues almost all arid, semi-arid and sub-humid areas of northern China and has become a challenge facing more than 1.6 million km² and 200 million people' (Wang, Xue, Zhou & Guo, 2012, 1). These scientists present a case study of Balinyou County in Inner Mongolia, an area that has suffered from aeolian desertification, where fine soil particles and soil organic matter has been eroded by the wind. The most efficacious control measures adopted were dune stabilization using wheat straw checkerboards, the erection of wind shelterbelts of trees and the protection of grasslands using fenced-off areas that prohibit or rotate grazing within the enclosed land. Over a seven year period the migrating dunes had become fully rehabilitated with grasses, the shelterbelts protected only the best selected farmlands on the low-lying alluvial soils and grain yields increased markedly, and, in the fenced-off land average vegetation cover increase from 40 to 85%. (Wang, Xue, Zhou & Guo, 2012,13).

The inspirational text for this section is *The Political Economy of Soil Erosion in Developing Countries* (Blaikie, 1985). Johnston (2009, 46) explains that social science is the study of human society drawing from disciplines such as economics, political science and sociology. During the second half of the 20th century human geography moved away from a position that occupied the nexus between the arts and physical sciences towards full inclusion in the social sciences. This juxtaposition at first led to a preoccupation with spatial science and then an engagement with more diverse approaches, which, in this context include modernisation theory, the dependency school of development, post development and postcolonial theories.

Blaikie's text is unusual because it still advocated a link between human and physical geography as its focus. In doing so he brought together a number of approaches interlacing together ideas about soil erosion, politics and economics, combining scientific claims about soil erosion with a Marxist metanarrative. He advocates an approach that combines the study of the essential physical and social approaches in the political economy of soil erosion.

'Such a study must include a 'place-based' analysis of soil erosion – where it actually occurs, where flooding and siltation caused by soil erosion in one place affects another, and where land-users have been spatially displaced to and from. It must also include and combine 'non-place-based' analysis of the relations of production under which land is used, the technology used and why, prices, taxes and so on' (Blaikie, 1985, 5).

The text also marked a significant step forward in the ideas that underpinned political ecology, which combined the concerns of ecology and broadly defined political economy. Political ecology initially was concerned with human and physical approaches to land degradation using a theoretical approach to the ecological crisis that contained detailed local place-based studies and general principles (Peet & Watts, 2004, 7), and encompassed 'the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself' (Blaikie & Brookfield, 1987, 17).

Geographer Nick Middleton demonstrated how Blaikie's text and the adoption of political ecology approaches affected studies of desertification.

'Slowly, the United Nations and other international bodies have come to realize that many programmes to combat desertification have failed because they have concentrated almost exclusively on the physical symptoms rather than the societal, economic and political diseases. Too great a reliance on technical solutions to dryland degradation problems is now giving way to a more balanced approach in which the political contexts, economic realities and cultural backgrounds of land managers are being taken into account. New emphasis is now being placed upon local community participation, redeployment of traditional coping strategies in times of environmental stress, such as drought, and tackling problems which stem from the marginalization of rural inhabitants by traditionally urban-based governments' (Middleton, 1997, 78).

Desertification, as a social construct, has varied greatly over time and space, its many meanings and numerous definitions have created a bewildering multisided 'social fact'. Robbins (2004, 12) argues that the goal of political ecology is to 'take the hatchet' to environmental myths, using the tools of science and social science to expose the false assumptions and unsuitability of certain ecological models. Stott and Sullivan (2000, 2) explain more fully that political ecology is concerned 'with tracing the genealogy of narratives concerning "the environment", with identifying power relationships supported by such narratives, and with asserting the consequences of hegemony over, and within, these narratives for economic and social development, and particularly for constraining possibilities for self-determination'.

There are several prevailing 'myths' surrounding desertification. Some are expressed as narratives, some as prevailing discourses. Old paradigms have been defended and new paradigms have been developed about desertification.

The desertification paradigm

The desertification paradigm sees dryland ecosystems existing in equilibrium, a steady stable state driven by the interaction socioeconomic and biophysical factors acting in tandem. A disturbed ecosystem state occasioned by extreme fluctuations in rainfall leading to droughts, extensive and frequent bushfires and human induced changes set in spin a spiral of destruction (Cleaver & Schreiber, 1994), a diminution

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Above: The Kyrgyz Chuya, Central Asia. Source: Wikimedia Commons

in ecosystem productivity ending in irreversible land degradation—that is, desertification (Safriel & Adeel, 2005, 645). The paradigm holds that population growth intensifies pressure on drylands, that overgrazing and the expansion of land under the plough leads to such land degradation (Tolba, 1992, 58). Put more explicitly, according to the World Bank, the Sudano- Sahel belt, ‘features one of the most rapid annual population growth rates of the continent, despite the fact that in many areas the mainly rural population . . . is already beyond the carrying capacity at current technological levels. This growth has resulted in a downward spiral of extensive land degradation and fuelwood shortage’ (World Bank, 1996: 24).

This is a dire situation, amplified when droughts occur, reduce soil and plant productivity. Fallow periods are shortened in rain-fed dryland croplands and irrigation salinity occurs where groundwater and external water supplies are used. Anthropogenic drivers of desertification could be global, as in the demand for cash crops, regional such as changes in land tenure as well as scientific and technological such as the building of concrete lined wells or prohibitions against the movement of livestock. All this results in reduced land productivity (Brown, 2008, 94) and is evident in increased poverty, malnutrition, poor health that, in turn, results in catastrophic famine and increased mortality rates. Rural-urban migration ensues and environmental refugees add to the problems of poverty, urban sprawl (Tolba, 1992, 62) and political tensions (WCED, 1987, 7). It is a chain of processes (Blaikie, 1985, 19) driven by anthropogenic change (Carwardine, 1990, 72) leading through a downward spiral of productivity loss and increasing poverty. To make matters worse, the paradigm implies, that aridity is cumulative, built into a feedback loop whereby desertification is irreversible (Cleaver & Schreiber, 1994, 29). Because areas of desertification are seen to be associated with areas of widespread grazing and crop production thus agricultural practices are blamed for desertification. The poverty that ensues means that the considerable investments that are required to redress desertification are in short supply. It is a very powerful and pervasive paradigm.

According to Chapter 12 of Agenda 21, which focuses on desertification, one-quarter of the total land area of the world suffers from desertification (Keating, 1993, 21). Further, the Secretariat of the UN Convention to Combat Desertification, which came into force in December 1996, stated that 250 million people are directly affected by desertification and that one billion are at risk (Adger, Benjaminsen, Brown & Svarstad, 2001, 690).

Exploding the myth of desertification

As early as 1994, Geographers, David Thomas and Nick Middleton examined desertification as a social construct. The power relationships contained in their conclusions are self-evident.

Four findings were laid out in *Desertification Exploding the Myth* (Thomas & Middleton, 1994):

- i. the global extent of desertification seems to be grossly exaggerated using inaccurate data, often based on guesswork, a ‘voracious process’ affecting one third of the world’s land surface;
- ii. dryland ecosystems, rather than being regarded as fragile ecosystems, are well adapted to environmental stresses and often appear to exhibit good recovery characteristics;
- iii. desertification and drought have been used as scapegoats for human suffering and misery masking more serious causes, including political mismanagement, and poorly run economies; and
- iv. the UN created desertification as an ‘institutional myth’ creating much misinformation about colonial stereotypes of overgrazing and advancing deserts that ignored more reliable scientific and social scientific findings (Thomas & Middleton, 1994, 160–1, Evans, 2012, 264–5).

Desertification narratives

Social Scientist Jeremy Swift (1996) explains the pervasiveness of the desertification narrative, identifying three groups interested in perpetuating the construct. The first group is the authorities—first the French or British colonial authorities in sub-Saharan Africa, and later national governments. They have used

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the narrative about desertification to justify government rather than household control over land and resources. Secondly, some sections of the overseas aid lobby have used the image of the spreading desert to collect funds, especially for planting trees to stop desert encroachment. Finally, some self-interested researchers promote an image of environmental deterioration in the Sahel in order to pursue research grants focused on desertification.

The desertification crisis narrative is well expressed by Social Scientist Emery Roe: 'Crisis narratives are the primary means whereby development experts and the institutions for which they work claim rights to stewardship over land and resources they do not own' (1995, 1066). Other, often cited, desertification counter narratives include the argument that smallholder farmers are not as responsible as commonly thought for deforestation in West Africa (Fairhead & Leach, 1996). The argument is that 'forest islands' in the savanna of Guinea are created and sustained by human action rather than the remnants of an extensive forest ecosystem; an ecology of disturbance rather than one of equilibrium (Jacobs, 1999). Historian Bill Gammage (2011) describes a pre 1788, similarly fashioned, park-like landscape in semi arid and dry sub humid Australia. Another narrative tells that desiccation and desertification may not result primarily from overgrazing or human settlement in the savanna landscapes of Côte d'Ivoire (Bassett and Zuéli, 2000, 69). Further, 'In contrast to the view that wooded savannas are becoming desertified, characterized by a progressive loss of trees and an expansion of grasslands, we argue that the landscape is becoming more wooded' (69).

Melissa Leach and Robin Mearns (1996, 11) observe, 'perhaps the best known supporting narrative from social science is the so-called "tragedy of the commons" argument, used to support received wisdom about drylands environmental changes. They explain that a strong counter narrative refutes it explaining that dryland savanna ecosystems can be managed

sustainably. Most collectively grazed pastures are not open access but are, or have been, collectively managed by identified groups of users (Swift, 2003, 5). So-called 'tragedies' occur when governments restrict open access to grazing land and interfere with the rational practises of pastoralists. The "tragedy of the commons" argument is often used to support the conviction that the world's deserts are "on the march," in spite of an absence of reliable empirical evidence to support that view (Swift, 1966).

Norwegian Geographer Tor Benjaminsen in (Adger, Benjaminsen, Brown & Svarstad, 2001, 691-2) examined a particular narrative about the links between the collection of fuelwood, deforestation and 'deserts on the march' in two regions in Mali. He found that all the wood used by villagers in the Gourma region in northern Mali was dry wood collected from dead trees. There was an abundance of dead wood available because of unpredictable rainfall and the frequency of droughts. The other region studied was the densely populated cotton zone of southern Mali. Collecting data from some fifty villages he found that the amount of green wood collected was sustainable in terms of forest regeneration. Only one locality near a major road suffered severe depletion where fuelwood was collected to be sold in urban centres.

Leach and Mearns (1996, 3) point out that there are three important factors that are overlooked when it comes to this narrative:

- i. most fuelwood comes from surplus wood left over from clearing land for agriculture, or from lopping branches off trees used for many purposes such as the provision of shade, building materials or edible fruits;
- ii. surveys of woodlands as defined by foresters greatly underestimates other sources of fuelwood such as those from smaller trees and woody shrubs; and
- iii. where there is a realisation of fuelwood shortages people tend to respond in various ways, such



A family collects branches for firewood, East Africa. Source: Oxfam (Wikimedia Commons)

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as reducing fuel consumption, or planting or encouraging the natural regeneration of trees.

African studies scholar William Beinart (1996) makes reference to a politically inspired narrative in South Africa. Under apartheid desertification was supposedly caused by the destructive farming practices of white farmers. 'Yet time-series evidence tells a rather different story of general stability in grassland composition over the period in question' (Leach & Mearns, 1996, 12).

Neil Adger and colleagues tell the tale of,

'The most famous and often-repeated story relating to desertification concerns the observations of an ecologist, Hugh Lamprey, in a reconnaissance flight over an area in the Sudan in 1975. The story has been used extensively to present the extent of desertification. Lamprey was assigned by the UN to give an estimate of desert encroachment. Using a light aircraft he compared what he observed in 1975, which was just after a severe drought, with a vegetation map from 1958, at the end of an exceptionally wet decade in the Sahel. The conclusion drawn was that the Sahara had moved south by 90-100 km from 1958 to 1975. This implied an average desert advance of 5-6 km per year (Lamprey, 1975). Subsequently, these data have been widely-quoted by governments, international aid donors and the media, and have entered school textbooks as an example of irrefutable facts pointing to a global environmental crisis. This is an apposite example of how a single narrative has contributed significantly to the institutionalization of a crisis discourse' (Adger, Benjaminsen, Brown & Svarstad, 2001, 690-691).

These scholars identify two discourses, with associated narratives, that support the idea of desertification:

- the neo-Malthusian discourse that depicts over-population in drylands as the main problem, a problem that leads to land degradation and fuelwood shortages; and
- the populist discourse explains land degradation by marginalization of smallholders and pastoralists caused by colonial and subsequent neo-colonial exploitation, an explanation that incorporates political economy viewpoints.

'Both the neo-Malthusian and populist discourses on desertification have proven to be powerful and have informed state intervention and the aid industry' (Adger, Benjaminsen, Brown & Svarstad, 2001, 691).

Arid lands scientists Stefanie Herrmann and Charles Hutchinson (2005, 549) refer to these two discourses

the Global Environmental Management (GEM) vs. the populist discourse. According to the GEM discourse, one inspired by modernisation theory and neo-Malthusian assumptions, people cause desertification, and yet, these land managers are at the same time the victims of the same process. Scientists, aid bureaucrats and national civil servants are depicted as heroic figures that provide solutions to environmental problems. The GEM discourse is interventionist and technocratic whereby environmental issues such as desertification require urgent and international action (Bettini & Andersson, 2014, 163). This discourse is reflected in the United Nations 1977 Plan of Action for Combating Desertification that was superseded by the UN Convention to Combat Desertification.

Desertification actually appeared on the agenda of the 'Earth Summit', the UN Conference on Environment and Development, Rio de Janeiro, 1992, because of a strong lobby from African delegates. It was successful because the United States was suffering from criticisms over its environmental policies and a failure to support the Biodiversity Convention and a 'go slow' in the preparations for the Climate Change Convention. Support for the Desertification Convention was a 'trade off' between 'North' and 'South'. European Union and United States support for the Desertification Convention ensured African support for the other two pillars of the Earth Summit of 1992 (Adger, Benjaminsen, Brown & Svarstad, 2001, 690).

In the populist discourse, with its philosophical groundings in Marxism, dependency school of development (see for example Franke & Chasin, 1981 examined in the last section) and post development critiques (Escobar, 1992, 144) sees global capitalism, transnational corporations and northern consumers as the 'villains' whose actions have caused a marginalisation of local farmers and pastoralists. While the local land managers are considered to be both as victims and heroes capable of sustainable management of their natural environment.

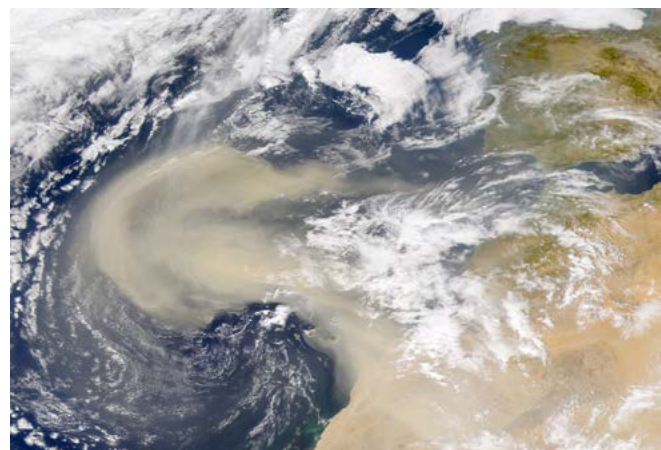
Geographer Alan Grainger (2009) refers to the desertification myth as a denial narrative. Inclined to support the populist narrative, he refers to the geographers and other scientists that were excluded from the United Nations Environment Program's group of experts. Scholars that challenged some scientific concepts agreed at the United Nations Convention on Desertification, e.g. the role of fuelwood cutting in causing desertification, the 'unidirectional and irreversible frontier expansion of desert fringes' (Grainger, 2009, 418) and the overestimates of the global extent of desertification were ignored for a long time.

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He says that a contemporary view of desertification reveals a complex phenomenon involving interactions between multiple causal factors, one that varies over time, from context to context and from place to place.

Geographers Simon Batterbury and Andrew Warren explain that 'laying the desertification discourse to rest is difficult' (2001a, 3527). They identify six themes that are essential elements of the desertification debate:

- Advance of desert – the Sahara Desert expansion has not been proven. The current view is that the Sahara expands and contracts in response variations in precipitation.
- Resilience of dryland ecosystems and land-use systems – semi arid ecosystems are resilient rather than fragile. They exist in a range of semi-permanent 'states' well adapted to periodic attack from droughts, bushfire and insect plagues. In addition, many indigenous management systems effectively create 'enriched' patches in the landscape.
- Influence of grazing and livestock – the diversity in dryland environments and the 'enriched' patches that follow on from pastoralist grazing strategies are critical to many drylands. It is difficult to overgraze in a dynamic non-equilibrium system, dominated by annual grasses, where the external forces like drought are more powerful controlling animal numbers – drought precludes the growth of annual pastures.
- Effects of increased population in rainfed, dryland agricultural systems – there is not necessarily a neo-Malthusian link that exists between increased population and resource degradation. Empirical evidence suggests that there is an incentive for rural people to invest in conservation measures in these circumstances – more people may mean less erosion.
- Soil erosion and fertility decline – although topsoil erosion does occur in drylands such soil can accumulate down-slope or down-wind as a valuable resource for others. Many indigenous dryland soil conservation systems are impressive.
- Climate Change – the biogeophysical feedback mechanism, referred to in an earlier section, is disputed. Potential global warming and global teleconnections between sea surface temperatures and climate anomalies will have differential, and as yet uncertain effects on drylands. In 2001, the IPPC observed, 'Africa is the most vulnerable region to climate change, due to the extreme poverty



NASA image of an African dust storm. Source: Wikimedia Commons

of many Africans, frequent natural disasters such as droughts and floods, and agricultural systems heavily dependent on rainfall' (cited in Mortimore, 2010, 134).

The various discourses about desertification and the narratives that support them still emerge in the literature, see for example Bettini and Andersson, (2014), but a number of scholars are also now working within the confines of the GEM discourse, i.e. producing materials under the broad United Nations banner. They also manage to do so by incorporating the populist discourse and other research from the physical sciences and the social sciences more broadly. The '**Dahlem Desertification Paradigm**' (Reynolds, Stafford Smith & Lambin, 2003), '**Millennium Ecosystem Assessment on Ecosystems and Human Well-Being: Desertification Synthesis**' (Millennium Ecosystem Assessment, 2005), '**International Geographical Union's Commission on Land Degradation, Desertification**' (Conacher, 2006) and '**Drylands Desertification Paradigm**' (Reynolds et al, 2007) are all examples of this process.

The two 'Desertification Paradigms' are examined here.

The Dahlem Desertification Paradigm

The very core of this model is the unambiguous assertion that desertification is a phenomenon that encompasses both biophysical and socioeconomic dimensions (Reynolds, Stafford Smith & Lambin, 2003, 2043). The Dahlem Desertification Paradigm arose out of two United Nations programs, Global Change and Terrestrial Ecosystems program and the Land-Use and Cover Change programs, which were part of overarching 'International Geosphere-Biosphere Programme'. The latter has the following vision 'to provide essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change' (IGBP, 2010). Researchers and scientist were brought together

to study desertification. A workshop convened in 2001 at the University, in the Berlin district of Dahlem, was titled 'Global Desertification: Do Humans Cause Deserts?' The findings were then published in a book with the same title (Reynolds & Stafford Smith, 2002).

Nine assertions make up the paradigm (Reynolds, Stafford Smith & Lambin, 2003). The first four stress the complex interconnections between biophysical and socio economic systems that drive desertification. They concentrate on systems behaviour such as the importance of slow variables, threshold effects and the non-linearity of systems. Others refer to the effects of geographic scale and time on desertification and the importance of local environmental knowledge (LEK).

The Drylands Desertification Paradigm

Building on the ideas expressed in the Dahlem Desertification Paradigm an article in *Science* (Reynolds et al, 2007) written by a host of Geographers, Earth Scientists, Environmental Scientists, Social Scientists and Agronomists outlined the Drylands Desertification Paradigm. This framework aimed to reveal various advances in science relevant to desertification and rangelands ecology. They also sought to include the vulnerability of people to change in drylands, as well as understandings of poverty alleviation and the role of community development practices. The researchers acknowledged that the United Nations had periodically focused on drylands, as in the Convention to Combat Desertification and setting aside 2006 as the International Year of Desert and Desertification, but they wanted to suggest a common framework for managing dryland systems to the wider scientific community. They enumerated five general lessons concerning the condition and dynamics of human-environment systems in drylands (Reynolds et al, 2007, 847).

- i. The need for an integrated approach, involving both researchers and land managers, acknowledging that ecological and social issues are intertwined.
- ii. An awareness that short term measures will not redress persistent, recurring problems nor will they cope with continual change.
- iii. An appreciation that dryland systems are not in equilibrium, have multiple thresholds and are subject to many different ecological and social states.
- iv. Recognition that problems and solutions at one scale influence and are influenced by those at other scales.
- v. Much greater value should be placed on local environmental knowledge (LEK).

The Drylands Desertification Paradigm consists of five principals that are based on the five general lessons and are consistent with contemporary understandings of the interconnections between biophysical and socioeconomic factors.

P1: Dryland human-ecological systems are coupled, dynamic and co-adapting, with no single target equilibrium point. They are a product of the interconnections between human-ecological systems, have distinctive histories and geographies and are the locus of change.

As far as biophysical systems are concerned Hutchinson and Herrmann (2005, 543) explain that the concept of 'equilibrium' dominated much ecological thinking until the 1970s. This concept, one that guided most land management policies, held that internal ecosystem regulation is achieved through negative feedback mechanisms that move the system toward stability. In effect, a 'balance of nature' is arrived at. An alternative point of view assumed permanent disequilibrium in arid ecosystems because both the populations of herbivores and the condition of the vegetation are so strongly controlled by unpredictable rainstorms and erratic seasonal conditions.

Similarly, the role that land managers, individuals, households and communities play, are adapted to non-equilibrium conditions. In dryland sub-Saharan Africa, 'Case studies show that adaptive strategies of small farmers include techniques to improve fertility, conserve water, manage trees, increase live- stock, and take advantage of changing markets' (Tiffen & Mortimore, 2002, 218). The disjunction between these two points of view led to complete misunderstanding about environmental decline after the Sahel droughts of the 1970s and 1980s. 'Inspired by the findings of the UNCOD in 1977, scientists and government officials portrayed the people of the Sahel as responsible for the degradation of their own environment, some going so far as to blaming West Africans for causing or at least exacerbating their own droughts' (Hutchinson & Herrmann, 2005, 546)

The Dahlem Desertification Paradigm would add 'At any particular point in time, a dryland system is the product of a set of complex interactions between biophysical factors (biogeochemical cycles, population dynamics, climate variability, etc.), social factors (conflict resolution, role of culture in shaping attitudes, etc.), and economic factors (supply-demand, economic stratification, work force, etc.)' (Reynolds, Stafford Smith & Lambin, 2003, 2046). The drivers of system change could be external such as the onset of drought and/or internal,

for example, a farmer's response to install drip-feed irrigation apparatus.

P2: The critical dynamics of dryland systems are determined by 'slow' variables (e.g. soil fertility, household capital wealth) rather than 'fast' variables (e.g. crop yields, household disposable cash). Put another way, soil takes a long time to develop in semi-arid ecosystems but economic changes are relatively rapid in drylands whereas educational and cultural factors are slow variables.

P3: Slow variables have thresholds that, if crossed, move the system into a new state or condition. When this occurs the cost of intervention to 'return' the system to the desirable condition or state increases. In other words, the costs of intervention rise non-linearly with increasing degradation.

P4: Coupled human-ecological systems are hierarchical, nested and networked across multiple scales. There are multiple stakeholders involved at each of these scales with differing objectives and perspectives that need to be acknowledged.

The Dahlem Desertification Paradigm goes further to assert that the accepted definition of desertification adopted by the Convention to Combat Desertification should be adopted at a broad scale but at the finer scale of the household or community land degradation should be used and more importantly it will always be necessary to define what factor is degraded. They liken desertification with 'sustainable development' or 'biodiversity conservation' as useful overarching concepts but of limited usefulness when applied at a scale of 10 hectares of rangeland (Reynolds, Stafford Smith & Lambin, 2003, 2045).

P5: The maintenance of a body of up-to-date LEK is key to functional co-adaptation of human-ecological systems. Local environmental knowledge, such as the Desert Knowledge initiative in Australia (Stafford Smith & Reynolds, 2003), should be integrated with science-based knowledge and mediated through effective institutional structures.

Again a scalar framework is implied because landholders operating at the household or farm scale may have different perceptions from interest groups operating at the regional, national or even global scale. For example the workshops conducted in Bolivia, Mexico and Honduras by the ARIDnet (Assessment, Research, and Integration of Desertification research network) scientists, a network that developed out of the Dahlem Desertification Paradigm, facilitate field-level interactions between researchers, local farmers, landholders and developers (Reynolds et al, 2007, 851).

The Humanities and Desertification

Denis Cosgrove has written a short essay *Geography with the humanities* (2011) in which he explains that the approaches used in the humanities involve a succession of commentary and criticism rather than the establishment of theories and laws 'although rules of evidence and logical argument are vital to their practice' (2011, xxii). He describes History as queen on the humanities but would also include other subjects, for example, Philosophy, Philology (language, literature, linguistics), Theology and the study of Art. Alison Blunt (2009, 66) would add Literary Studies, Archaeology and Cultural Studies to this list. 'The goal of humanities' study is still best encapsulated by the Greek aphorism: "Know thyself," and the idea that we best come to knowledge through the reflective study of exemplary human achievement' (Cosgrove, 2011, xxii-xxiii). Another text by Cosgrove *Geography & Vision: Seeing, Imagining and Representing the World* is chosen as the inspirational text for this section.

Eating the haystack

Geographer Les Heathcote wrote about desertification in an Australian context. He referred to the phenomenon of excess carrying capacity of livestock in arid and semi arid Australia during the Federation Droughts of 1895 – 1902. A station inspector for Dalgety and Co. gave evidence before the Royal Commission to Inquire into the Condition of the Crown Tenants, NSW, 1901, the inquiry into the Federation Droughts in the Western Division, NSW. He explained,

'There is no doubt that in my mind that the carrying capacity of the country was greatly overestimated by the early settlers. In its virgin state, with the saltbush and other edible bushes in their prime, there was hardly a limit, except as regards water, in the opinion of the settlers then to what the country could carry, and in many cases it was stocked accordingly, but they forgot in doing this that they were eating the haystack, and there was soon no crop growing to build another. Then the rabbits came along' (Heathcote, 1987a, 294).

The notion of carrying capacity has been alluded to in the previous section. Let it be said that it is a European or North American construct: a presupposition that 'every set of ecological conditions can support a given number of people and/or livestock which, once exceeded, will lead to a spiral of declining productivity' (Leach & Mearns, 1996, 9). However, it was not one that was evident in pre-colonial Australian environments. Nevertheless, Heathcote is obviously correct in his observations. The early settlers approached the

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Livestock during drought, Riverina . Source: Wikimedia Commons

Australian bush with no regard for carrying capacity, nor any knowledge of its ancient soils, aridity and unpredictable rainfall.

Heathcote (1987b, 10) explained that a series of 'desert outbreaks' such as those in the Flinders Ranges and northern parts of South Australian, in 1865, the Federation Drought years, 1895-1902, the 1935-40 widespread mid century droughts and the 1982-1983 El Nino drought in the Western Division, NSW, led to concerns about desertification, the perception of the expansion of the desert into more humid productive areas and subsequent economic distress in the rural community.

Michael McKernan (2005) believed that the 1982-1983 drought marked a turning point in Australian society, one where rural and urban dwellers began to understand the reality of drought as a recurring phenomena rather than a threat that presaged the notion of the expanding desert. The Millennium Drought, 2001-2009 was described as the worst drought on record in southeast Australia (van Dijk et al, 2013, 1040) and yet there was no mention of desertification in the popular press. There were other concerns: enforced water restriction in most major cities, increased electricity prices and the outbreak of catastrophic bushfires. Desertification in its many guises was not the focus of concern despite the decline in riparian River Red Gum forests and increased tree mortalities away from the rivers (2013, 1051)

Heathcote (1983, 164) referred to desertification in general,

'First came the removal of the edible species and thereby the encouragement of inedible species. Then, if pressures continued, the modification of soil and water conditions to the extent that all vegetation was removed and soil erosion became a major problem. Associated with this deterioration of the vegetation were rapid reductions in livestock carrying capacities, usually by massive deaths in droughts'.

The NSW Royal Commission of 1901, set up to investigate the effects of the Federation Drought, investigated six main causes for the appalling conditions in the Western Division: low rainfall and periodic drought, rabbit plagues, overstocking, large scale destruction of vegetation, the spread of woody weeds, or non-edible shrubs and the decline in prices of pastoral products (Holmes, 1983, 50). Heathcote (1965) quoted from the Sydney Morning Herald in 1899,

'It is the land of drifting desert sand and stone strewn ridges, of open treeless plains, and dense impenetrable scrubs. It is the home of the treacherous mirage, of disappointing salt lakes and fleeting waterholes, of drying winds and exasperating dust storms. It is the stronghold of the rabbit and the most frequent victim of the drought. It is, too, just now a land of buried yards and fences, of abandoned holdings and deserted homesteads, of broad acres but tragically shrunken flocks' (cited in Holmes, 1983, 50).

The journalist's description of desertification was substantiated by the Commission's investigations. Much of this rhetoric was to resurface in the Dust Bowl years in North America and the Sahel droughts of the 1970s and 1980s. All fill out our conception of desertification.

Alternative visions

There was of course, an alternative Australian vision articulated by Adelaide-based, Prussian-born entomologist, Johann Tepper. Writing in the *Agricultural Gazette of NSW* in 1896 he wrote about the country clothed in trees, 'the soil loose and porous, the banks of the watercourses thickly overgrown and lined with shrubs' (1896, 33, cited in Powell, 1993, 26). He went on, 'If the first settlers had thoroughly understood the inter-relation of plants and fertility, provision could easily have been made to conserve a due proportion of forest (and heath) land, and such devoted to tilling and pasture by an intelligent and wisely determined government' (1896, 35). Unfortunately,

'nothing was done to provide for the future; the country has gradually drifted to the verge of becoming a hopeless desert, like most parts of Palestine, Arabia, Persia, North Africa and even Spain, with similar climates and soils like our own, which history proves to have been thickly wooded etc., when supporting great nations and high civilisations' (1896, 36).

Desertification is seen here quite literally as a deserted place and a place made desert – empty of life, waterless and unproductive (Mabbutt, 1985).

But there is also another vision of Australia. Novelist Robert Dessaix (1991, 152) examined the psyche of the early European settlers explaining that 'the land is often feminine to Europeans, but given sense, owned, by generations of the masculine'. Historian Michael Cathcart (2009, 140) points to an oft-repeated theme in contemporary feminist readings of the land, the notion that nineteenth settlers thought of the land as a woman whom they were destined to conquer. Europeans, by and large, came from well-watered climes, 'it was fecund, moist, moody, manicured, colourful' (Dessaix, 1992, 212). And yet, 'The land the men came to was 'barren', dry, stable, unkempt, monochromatic and peopled by stick men with few possessions'. Coming to this harsh and barren land, according to Geographer Faye Gale, 'The saving power of technology was seen as essential to 'tame it'. But to the Aboriginal people the Australian landscape, whether desert or tropical; coast was a lush rich country provided one lived in a respectful relationship with nature' (Gale 1994, 22). Historian Bill Gammage remarked on the workload of Aboriginal

women in the arid land, 'I never saw an Aboriginal woman come in empty handed, though in 1935 there was a drought' (2011, 302). Furthermore, he stressed that mobility was the key, 'It gave the people abundant food and leisure and let them live in every climate and terrain' (304) and 'they usually lived comfortably in parks they made' (311). But more sombrely, 'Knowledge of how to sustain Australia, of how to be Australian, vanished with barely a whisper of regret' (323).

The adventures of a biologist in Australia

Heathcote (1987) explained that Francis Ratcliffe, brought from Britain to investigate the supposed 'desert outbreaks' of the 1930s, found the attitudes to drought 'extraordinary' and 'discouraging'. The primary assumption was that drought was an exceptional occurrence, whereas he suggested that people had to live with recurring droughts. In *Flying Fox and Drifting Sand the adventures of a biologist in Australia* (1947) he concluded that, 'the fodder reserve of the semi-desert country is nowhere sufficient to stand up indefinitely to the strain that must be placed on it by pastoral settlement' (Holmes, 1991, 53).

Such views were in accord with the many Geographers who have written on desertification. Grainger (1990, 65) cites four main types of poor land use as causes of desertification: overcultivation, overgrazing, deforestation and poor irrigation practices. Thomas and Middleton (1994, 82) add urban and industrial activities to this list. They also provided an expanded list of suggested root causes of accelerated land degradation including natural disasters, population change, under development, internationalisation (now probably referred to as globalisation), colonial legacies, inappropriate technology and advice, lack of knowledge about land degradation, institutional or personal attitudes to land degradation and, war and civil unrest (1994, 85). Andrew Goudie and Heather Viles (1997, 27) refer to the 'demographic explosion' that impacted on to the four factors identified by Grainger. Richard Huggett (2010, 47) would cast the net more widely referring to the primary causes of desertification as climatic variations, ecological change and socioeconomic factors adding drought, poverty, political instability and even desert warfare to Grainger's four main types of poor land use.

Stories of desert advance

As we have seen, as early as 1865 an awareness of desertification became apparent when drought devastated the pastoral lands of the Flinders Ranges and resulted in the demarcation of Goyder's Line, the isohyet that separates the mallee scrub from the saltbush

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A Break Away! An iconic painting of 1891 by Tom Roberts, depicts a time of drought in the Australian outback. Source: Art Gallery of South Australia

country, the northern limit of crop farming in South Australia. The 1901 Royal Commission increased anxiety about potential desertification and Ratcliffe produced a paper on soil erosion and sand drift in 1937 that investigated 'desert advance' leading to further disquiet about desertification in northern South Australia and southwest Queensland.

But it is the Federation Drought that has the greatest impact. Various writers expressed the uneasiness and the sense of despair about desertification in Australia.

'The excessive numbers of sheep and cattle denuded inland pastures and when, between 1895 and 1903, drought dried up the inland fertile crescent of eastern Australia – from Queensland, through New South Wales, Victoria and into South Australia – the land was devastated. East of the Darling, 90 percent of the original perennial saltbush disappeared. Grass also vanished from paddocks and topsoil began drifting and blowing away. Albermarle station near Wilcannia, New South Wales lost topsoil up to a depth of 30 centimetres from 40 500 hectares. The great drought culminated in a huge dust storm and the largest, on 11–13 November 1902, covered areas of South Australia, Queensland, New South Wales and Victoria. In Victoria, lightning and balls of fire accompanied gales of dust which so darkened the sky that fowls roosted in the middle of the day, and people used lanterns to get about.

When the droughts began, Australia had grazed 110 million sheep. Eight years later, 57 million sheep remained alive and pastoralists abandoned large tracts of sheep country. In 1891 the western division of New South Wales carried fifteen million sheep; less than half that number depasture there now. Sixty years after the great drought, the dead mulga

still stood, and some plants common before the drought, did not appear until 50 years afterwards (Lines, 1992, 131–2).

Journalist, Michelle Grattan revisited the Western Division of NSW to follow the footsteps of journalist and later war correspondent, Charles Bean. She mentioned the earlier writings of journalist and politician Edward Davis Millen who travelled around the Western Division of NSW and had his observations published in the Sydney Morning Herald in 1900. He wrote presciently that the normal condition of the West was drought 'punctuated with occasional moist seasons' (2004, 46).

Bean had written *On the Wool Track* (1910) about the inquiry carried out by the Western Lands Commission. He described western NSW as bad and black and hopeless as it could be: the country had been made a desert (2004, 53). He described the land around Bourke as a mass of shifting red and grey sand where dead sheep and fallen tree trunks initiated sand hills 'the West was literally not different from the Sahara Desert' (2004, 82)

Eighty years later the Western Lands Commission was more ambivalent about the Western Division. Somehow the spectre of desertification had faded. 'The region is predominantly flat. It is hot and it can be dusty. But it can be mild and lush and there is natural beauty in the rolling plains of Mitchell grass in the harsh ridge country or among the red gum forests which flank the major rivers' (Western Lands Commission, 1990, cited in Grattan, 2004, 57). Nevertheless, as early as 1946 geographer James Macdonald Holmes was sufficiently concerned about the future of the Western Division of NSW that he suggested it might revert to a national park (Heathcote, 1987b)

The impacts of overcultivation are alluded to in the following extract where a group of Western Australian social scientists addressed one of the prime causes of *The Salinity Crisis*,

'In Western Australia until the end of the first World War clearing heavily timbered country was done by axe, and hand-made rollers. Even clearing by axe alone, a strong skillful worker could clear between half and one acre a day, although the process of stacking and burning was a much slower job. But evidence of development could be found all over the expanding wheat frontier. Burning operations after mid-February darked the sky with smoke by day and left myriads of twinkling log fires at night' (Beresford, Belke, Philipps & Mulcock, 2001, 44)

Michelle Grattan referred to the visit of Russell Drysdale to the western division in 1944, along with a Sydney Morning Herald journalist and photographer. Drysdale

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Dust storm, Stratford Texas, 1935. Source: Wikimedia Commons

sent back images of cattle rotting in the earth and twisted trunks of apparently tortured trees in a dead and dying landscape (Mulligan & Hill, 2001, 67). He showed resilient people in a landscape of skeleton trees, derelict windmills and dying soil (Grattan, 2004, 87). 'South of Broken Hill, where 600,000 sheep died in one corner of the State, Drysdale remembers being given cold drinks and a meal in a home surrounded by sand dunes higher than its roof, and in which all the ceilings had collapsed. The talk in these stricken areas was not only of loss, but of development and irrigation' (Burke, 1951, 12).

Nevertheless, contemporary newspaper accounts seemed to focus on the Western Division of NSW becoming a sandy desert like those in North Africa rather than on the stoicism of the landholders, as instanced in the *Finley Mail*, 15 November 1944 (McKernan, 2005, 196). And, Sydney's *Daily Telegraph*, 4 November 1944 predicted, 'it will be of no use to anyone except future archaeologists who will have to dig under sand hills to find the remains of an extinct civilisation' (196). Michael McKernan wrote of Drought as *The Red Marauder*. He wrote of drought, of drought and dust storms, drought and bush fire: occurrences that would return to visit Australia. 'They never really leave it' (2005, 269), he said. This is a much more fruitful way to think of desertification in Australia. As Historical Geographer Joe Powell remarked, terms like desertification derive from the vocabularies of 'anxious scientists and sensationalising magazines and newspapers' (1993, 9).

Armistice Day 1933

Pulitzer Prize winning author John Steinbeck immortalised the Dust Bowl,

'The dust from the roads fluffed up and spread out and fell on the weeds beside the fields, and fell into the fields a little way. Now the wind grew strong and hard and it worked at the rain crust in the cornfields. Little by little the sky was darkened by the mixing dust, and the wind felt over the earth, loosened the dust, and carried it away. ... The

wind grew stronger, whisked under stones, carried up straws and old leaves, and even little clods, marking its course as it sailed across the fields. The air and the sky darkened and through them the sun shone redly, and there was a raw sting in the air' (Steinbeck, 1939, 1-2).

Marc Resner was no stranger to evocative prose either, 'The first of the storms blew through South Dakota on Armistice Day, November 11, 1933. By nightfall, some farms had lost nearly all their topsoil. "Nightfall" was a relative term, because at ten o'clock the next morning the sky was still pitch black. People were vomiting dirt. Machinery, fences, roads, shrubs, sheds – everything was covered by great hanging drifts of silt. ... A naked human tethered outside would have been rendered skinless – such was the scouring power of the dirt-laden gales. Huge numbers of jackrabbits, unable to close their eyes, went blind. That was a blessing. It gave the humans something to eat' (Resner, 1986, 155).

Drought is a reoccurring phenomenon on the Great Plains of the United States of America and every time it resurfaces atmospheric scientist Michael Glantz thinks back to the great debate that took place in the 19thc whether the Plains would revert to an unproductive desert or whether it would become a 'sustainable garden' as the humid Eastern States were perceived (Glantz, 1994 29-30). The Dust Bowl was to return twice more in the 20thc (Millennium Ecosystem Assessment, 2005, 16) after Dust Bowl I in the 1930s. These events reoccurred despite all the policy interventions, economic reforms and the migration of 1 million people out of the Great Plains between 1940 and 1970. Dust Bowl II that occurred in the 1950s damaged more land than Dust Bowl I (Thomas & Middleton, 1994, 22); and Dust Bowl III in the 1970s caused as much soil loss as the 1930s event (1994, 22). Geographer Mark Whitehead (2014, 66) refers to Dust Bowl I as a defining moment in the Anthropocene, one of the most devastating human-induced ecological disasters in history. It was also an example of the use of opportunistic politics and hyperbole regarding desertification. David Thomas (1997, 587) explained,

'In the 'dirty thirties' the dust bowl soil erosion issue in the USA and the desire to get public funds for relief efforts led Secretary of State, Dean Acheson, to advise President Truman to take an alarmist stance in a forthcoming speech to Congress: 'Scare Hell out of them Harry, or nothing will be done'

Woman in the Dunes

Hiroshi Teshigahara's award-winning 1964 film *Woman in the Dunes* is set in vast expanse of coastal sand dunes stretched out along the Japanese coast. In a giant swale in the dunefields sits a ramshackle dwelling, surrounded by cliffs of sand, whose owner exists for only one purpose: clearing away the sand. Her house lies on the edge of a village threatened by the advancing wall of sand. She has lived alone since her family were lost in a sand storm. Unless the sand is removed the entire village will be lost. The *Woman in the Dunes* is one of a number of captive workers who shovel sand every day to protect the village from the advancing dunes. Another captive, a teacher from Tokyo who strays into the sand pit on an expedition to collect insects, joins her.

Geographer Matthew Gandy examines the film in the context of representations of landscape to explore the projection of human values, hopes and fears in this sandy wasteland. He says, 'Modern Japan is presented as a spiral of entrapment: the man is caught within a faceless society that regards its workers as little more than automatons while the woman represents a lonely outcast from Japan's post-war miracle' (2010, 203). Advancing sand is essential to the plot of the film as sand slides down the dune slopes and is borne remorselessly onwards by the wind. Geologist Michael Welland explains, 'sand is the enemy but also the central character' (2010, 133).

The actual central characters, deserted by the villagers and wider Japanese society are stranded in a wasteland, an alien place: a desert. At the end of the film it is revealed that the man has been absent for seven years and is now classified as a missing person. The advancing sand threatens civilisation. The metaphor is a powerful one; one that permeates much thinking about desertification. It is difficult to shift notions of advancing walls of sand towards the currently accepted concept of land degradation in drylands. As geographer Jack Mabbutt remarked 'the symbol of the palm tree disappearing under the advancing sand is locally warranted, but as a general view of desertification it could lead to mistaken combative strategies' (1985, 1).

Environmental visions of the Maghreb

The most common 'vision' about desertification, accelerated land degradation in the Maghreb states of Algeria, Tunisia and Morocco is one of human-induced change despite the fact that the region has experience significant climatic fluctuations over the past several thousand years. Meteorologist Kenneth Hare concluded that desert expansion in North Africa was largely

a consequence of unwise human decisions set in a framework of recurring droughts (Blaikie & Brookfield, 1987, 123). But others are not so certain. It may be that human ingenuity actually impeded natural erosion rather than accelerated it. It may be that in the centuries after 1000 CE when intensive agricultural methods declined that accelerated land degradation increased (1987, 126).

Historian Diana Davis has an interesting reading of the environmental history of the Maghreb viewed through the prism of French colonial engagement with this part of North Africa. She analysed environmental change during the French colonial occupation of the Maghreb between 1830 to about 1956 using evidence from the classics, history and colonial art. The dominant narrative created during this period was based on French interpretations of ancient Greek and Roman writings about North Africa. But,

'It is a false story of environmental decline at the hands of the "invading Arab nomads" and their voracious herds. It was wielded like a weapon during the heyday of French colonialism in North Africa from the 1860s until independence to justify and facilitate imperial goals' (Davis, 2010, 171).

Before French occupation of Algeria in 1830 the prevailing vision was of a fertile and bounteous land that was not reaching its potential under Ottoman rule and peopled by lazy "natives." After occupation the story began to change with the nomadic herders being blamed for turning Algeria into a desert through overgrazing, deforestation and through burning off the vegetation. In fact, the evidence for extensive forests over the Maghreb is very thin with most deforestation occurring from the 1890s to the 1940s. The French however saw the landscape as a degraded space and it was the duty of France to plant vast forests to bring back the rains. This exposition allowed for the expropriation of the land from North Africans. French forestry experts mapped the supposed former forests using subjective judgements over the former extent of the natural vegetation of the Maghreb. So powerful did this vision become that a French scientist published evidence from a series of pollen cores in the 1970s that appeared to show significant deforestation that was coincident with the 11thc "Arab invasion" (175). Subsequent tree ring analysis in the 1990s in the Rif Mountains indicated that there had been a severe drought from 1100–1250 CE and this was what the pollen cores showed rather than the march of the Arab tribes.

Davis explains that biophysical data makes up only part of the story of environmental change. She says, 'We also need to understand what various people and cultures

believed about the environment and environmental change over time and how and why they acted on those beliefs' (170–171).

The impact of foresters has had a marked impact on the development of thinking about desertification. Louis Lavuaden used the term in 1927 when he was working in the forest service in Madagascar. He explained that in order to end the desertification process in the Maghreb extensive tree plantations, restricted grazing rights, a series of protected reserves and the suppression of bushfires were essential policies to be implemented. He saw desertification as even more precarious south of the Sahara, because there the French had to deal with "primitive people" who were incapable of understanding "the purpose of rules" (Benjaminsen & Berge, 2004, 42). Another forester, Aubréville is more generally acknowledged as the first person to coin the term when, in 1949, he noticed that the Sahara Desert was expanding into the surrounding savanna (Huggett, 2010, 47).

And then there are Stebbing's accounts from West Africa. Edward Stebbing, also a forester, addressed an audience at the Royal Geographical Society in London on 4 March 1935. He travelled through the savanna lands of West Africa from the Côte d'Ivoire through to Nigeria reporting on large herds of cattle and flocks of sheep and goats clustered around waterholes and great fires crossing the countryside, all living and taking place a mere 30 miles from the outskirts of the Sahara. He explained,

'The people are living on the edge, not of a volcano, but of a desert whose power is incalculable and whose silent and almost invisible approach must be difficult to estimate. But the end is obvious: total annihilation of vegetation and the disappearance of man and beast from the overwhelmed locality' (Stebbing, 1935, 510).

Journey through a dead land

Schoolteacher Michael Asher journeyed to the Kababish dar, the land of the Kababish, in northern Sudan in 1982 at the height of the drought in the Sudano-Sahel. The perception of the drought in Sudan was so acute that on March 14 1986 the then Vice President of the USA, George Bush senior, urged that aid should be dispatched to the country because 'desertification was advancing at 9 km per annum' (Binns, 1990, 107).

'The sand looked fresh and pristine as if no other foot had ever trodden there. There were stumps of dead trees and little heaps of deadwood that crumbled to a powder at the touch. 'Look at those trees!' Jibrin said. 'This was the famous Sallaym pastures. A few years ago all the Kababish in the north used to collect here. There were sallam

trees and tundub and siyaal. The sands were green with grasses. You could not move for camels, and there was as much game as you could hunt. There was gazelle, oryx and even ostrich. I know men that saw herds of them, twenty at a time.'

'What happened?'

'The grazing got less every year, and the rains failed. There was never much rain here, but enough to bring grazing along the wadis. Then the trees died and the Arabs of the Nile came and chopped up the rest for firewood.'

'Will it bloom again?'

'Only God knows but I don't think it will bloom here. If they had left something, the tops of the trees, and just collected the fallen wood it would have been better. I have seen sallam trees go for years without water. You think they are dead, but the spirit is still in them. It just needs a shower of rain and shushsh! They are green again. But this is a dead place. They have left nothing' (Asher, 1986, 298).

One could be forgiven here in conjuring up an image of the advancing Sahara or irreversible desiccation but to reiterate, in contrast to popular perceptions; desertification is not the natural expansion of existing deserts, but the dispersed, patch-like degradation of land in arid, semi-arid, and dry sub-humid areas (Grainger, Stafford Smith, Glenn, & Squires, 2000, 365). Again, we have to point to recent research suggests that the drylands are resilient places and that local African pastoralist strategies have developed highly flexible mechanisms to cope with highly unstable environmental conditions (Adger, Benjaminsen, Brown, & Svarstad, 2001, 691).

Ulf Helldén and other Swedish Geographers at the University of Lund who demonstrated, in the 1980s, through a combination of fieldwork and the analysis of satellite images in Sudan, that there was no systematic advance of desert in the Sahel, nor was there a reduction of vegetation cover, although woody weeds had invaded some areas. They established conclusively that drought caused dramatic changes to the land cover and that productivity recovered completely at the end of the drought (Nicholson, 2011, 434).

The Trek of Sidi Mohammed

Anthropologist Richard Franke and sociologist Barbara Chasin wrote a classic paper titled *Peasants, Peanuts, Profits and Pastoralists* (1981) that examined the role of the nomadic pastoralists in exacerbating land degradation in the Sahel during the savage droughts of the 1970s. The paper is representative of what has been



2011 Drought in the Horn of Africa Source: Wikimeia Commons

termed “the large body of literature on the Sahel” that has emerged since the 1970s (Blaikie & Brookfield, 1987, 108). The authors attributed blame to the peanut producers further south effectively pushing the pastoralists northwards into the desert fringes. They also questioned the ambitious development plans that forced the nomads to become sedentary herders.

Sidi Mohammed gave testimony before the United States Senate Hearings on *World hunger, health and refugee problems. Part IV: Famine in Africa*, in March 1974.

‘Sidi Mohammed, a Nigerien herder took his family of ten, including his mother, brother, Sidi’s wife who had recently given birth, and six children, including the infant, and began heading south. They took with them two camels and three donkeys. They left their home after the herds had died, their destination, a town where food was supposedly available. His wife died on the way, the infant son, without his mother’s milk “wasted away to skin and bones.” He too would die. Sidi desperately tried to give away his two youngest daughters since he could not feed them, but no one was able to take them on. When they arrived in Maradi, almost at the border with Nigeria, and a major peanut and staple crop region, they discovered there was no food to be had. They sold their animals and the sons went begging. The family finally took up residence in a refugee camp, hoping the rain would come next year and somehow they could go back up north and begin again’ (Franke & Chasin, 1981, 156).

Franke and Chasin explained that the people that bore the brunt of the 1973 Sahel drought were the pastoral peoples that lived in the Sahel on the edge of the Sahara Desert. The nomadic pastoralists were formerly in contact with farmers further south bringing their animals in during the dry monsoon season to fertilise the soil with their dung and urine and graze on the stubble in a reciprocal arrangement between farmers and graziers. Then came the great surge in groundnut (peanut) production. Between 1934 and 1968 there had been a six-fold increase in the area sown to groundnuts. The traditional ability of the pastoralists to migrate across the savanna, to chase the fluctuations in annual rainfall and emulate the natural migrations of the wildebeest and white-eared kob, had become increasingly constrained (Goudie, 1986, 49) Both African domestic cattle and the wildebeest and kob need surface water supplies as well as forage in order to survive (Sinclair & Fryxell, 1985, 988). Cattle traditionally remained in the northern part of the Sahel for three months or so during the wet monsoon season where the annual grasses were high in protein. The migration system had been operating for many centuries perhaps as long ago as 5000 years BP when domestic cattle first appeared in the Sahel (1985, 989).

The pastoralists relied on movement to survive in non-equilibrium drylands. They were able to rely on a variety of pastures, watering points and salt licks, realising that pasture growth is determined by last season’s rainfall. External experts had observed that the pastoralists

were continually moving in search of water as a consequence boreholes were dug in the southern Sahel and pastoralists were encouraged to become sedentary graziers. This had a number of implications. Firstly, the nutritious northern grasses were unavailable to them and then the lower quality perennials of the southern Sahel became grazed all year round with no respite. The grasses were eaten out in the wet season leaving little or no forage in the nine-month dry season particularly in the areas around the bores. Worse was yet to come as “bush encroachment” ensued with the invasion of unpalatable trees and shrubs. The perennial grasses that did survive are highly susceptible to small decreases in annual rainfall. The low rainfall totals in the 1973–1975 period were the proximate cause of the famine but the supposed ultimate cause was overgrazing, an occurrence complicated by the spread of cash cropping in the form of groundnut production and a complete change in the political economy of Niger.

Today, much more is known about desertification in the Sahel, and in Niger in particular. During the 20th century, the droughts of 1913–1914, 1931–1933, 1942, 1973–1974 and 1983–1985 were severe ones (Thébaud & Batterbury, 2001, 70). The much wetter conditions experienced in the 1950s and 1960s allowed pastoralists to restock their herds. Even after the 1973–1974 drought the herds were re-formed (Warren, 1995, 196). Evidence from Kenya suggested that after a two-year drought herds were re-established in only three years and, more importantly, the recovery process suggested little or no damage to pasture capacity (Warren, 1995, 196). Satellite data also showed significant greening during the 1990s after the drought years in the 1980s (Olsson, Eklundh & Ardo, 2005, 556).

As Batterbury and Warren (2001b, 3) explained in hindsight ‘It may well be that diversity and change have always been evident to the Sahelians themselves, and that is only being ‘rediscovered’ by scientists’. Traditional pastoralism in Niger should be viewed as an economic system that rarely has the opportunity to overstep carrying capacity because a severe, once a decade, drought culls the herd by 50 to 70 percent and the gradual rebuilding of the herd allows the pasture to gradually recover.

Nevertheless, the more recent droughts of 1973–1974 and 1983–1985 have had serious and long lasting effects on rural communities in the Sahel and, more particularly, on pastoralists. Thébaud and Batterbury (2001) examined pastoralist livelihoods in eastern Niger where they found that access to pasture and water, particularly from public wells and boreholes, has resulted in political tension and conflicts

between pastoral and agro-pastoral groups. Ironically, government efforts to provide secure watering points for the pastoral groups have initiated social conflicts and violence, rather than creating security. This is a long way from the cliché of the self-absorbed, irrational pastoral nomad, building up herds to enhance prestige and consuming pasture and water supplies at an unsustainable rate.

Conclusion

Environmentalism Norman Myers wrote about desertification in the late 1980s, a period of intense pessimism about our common environmental futures. He predicted that by the Year 2000 many more countries would be affected by the spread of deserts with some 900 million people then suffering from desertification set to rise to perhaps 1250 million sufferers (Myers, 1988). Physical geographers, empowered by geospatial technologies, have long since had a more sophisticated understanding of the spread of deserts. Environmental geographers have contributed an extensive portfolio of case studies from drylands that question earlier, simplistic assumptions about desertification. Piers Blakie’s insistence on focusing on indigenous land managers, with their toolkits of local wisdom and practices, and ‘chains of explanation’ (1987, 46) throughout the wider political economy, changed the ways in which geographers began to examine land degradation in drylands. Dennis Cosgrove’s endeavours to see, imagine and represent the world, added another dimension to enable geographers to disentangle this difficult conception. All these traditions better inform us about the most neglected and least understood leg of the troika of Conventions: on *Biological Diversity*, the *Framework on Climate Change*, and, to *Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa*, legally binding agreements ratified by most of the world’s nation states.

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Can we bring about change to reflect evidence based practice?

Susan Caldis

President GTANSW; HT HSIE Castle Hill High School

Introduction

For assessments to be perceived of as valid, reliable and effectively used as diagnostic tools, consideration needs to be given to as to whether they are 'fit for purpose'. Assessment tasks can be fit for one purpose but not all (Newton, 2007). There is a difference in type, need for, and audience of formative and summative approaches to assessment, however, used together these assessment approaches will form a holistic picture of where a student or cohort are at in demonstrating their learning and ability to meet desired and specified learning outcomes.

Across Australia, there is much debate about the appropriateness, desirability and effectiveness of current national assessment tasks and reporting practices. In NSW, the Higher School Certificate (HSC) examination at the end of Year 12 has distinct pros and cons. Nationally, the most controversial assessment task is the summative, multiple-choice based literacy and numeracy testing of students at Years 3, 5, 7 and 9. Whilst these national tests are not explicitly connected to the subjects of the Australian Curriculum suite, the tests are held on the same day, under reportedly the same conditions in each primary and secondary school around Australia. There is also a uniform marking guide and process associated with these tests – the latter three factors are argued to contribute to enhanced validity and reliability of the assessment. The results are then published on the My School website which inevitably leads to public scrutiny and comparisons between schools from various stakeholders. However, this is just one part of the assessment and reporting picture although it is the most sensationalised part in the media.

It is the focus placed on summative assessment approaches – those tasks that occur at the end of a sequence of learning, such as the HSC, the national literacy and numeracy testing or a school based topic test - that have reignited discussion about the place and value of formative assessment – those tasks that occur informally throughout the teaching and learning sequence and provide a feedback loop.

It is within formative assessment approaches that

Assessment for Learning (AfL) sits. AfL is often explained as a process by which teachers inform their practice using information obtained from analysis of and reflection on the extent of progress made by their students. Black, Harrison, Lee, Marshall and William (2004) define AfL as any assessment that firstly seeks to serve the purpose of promoting student learning, secondly provides information that can be used as feedback, and thirdly becomes a formative assessment approach when teachers amend or modify their practice in response to assessment findings.

The purpose of this literature review is to assess the extent to which researchers agree or disagree about the principles of Assessment for Learning in a Geography education context. The principles in question are: the need for effective planning and organisation by the teacher; the provision and quality of feedback; whether AfL is an effective formative assessment strategy; the need for the professional development of staff; the role and importance of self and peer assessment; and the role and importance of student-centred learning and learner autonomy. Throughout the literature review, these principles are not placed in an order of perceived importance.

What is Assessment for Learning (AfL)?

As part of this review, research from Australia, Israel, New Zealand, The Netherlands, the United Kingdom and United States of America has been explored. Authors such as Pat-El, Tillemans, Segers and Vedder (2013) cited the definition about assessment for learning (AfL) put forward by the Assessment Reform Group (2002) from the United Kingdom; "the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there" (cited in Birenbaum, Kimron & Shilton, 2011, p. 36). For the purpose of this literature review, this is the preferred definition. Additionally, many authors, including Dixon, Hawe and Parr (2011), and Cauley and McMillan (2010) also referred extensively to the work of Black, Harrison, Lee, Marshall and William (2004), Black and William (1998), and Sadler (1989) as key reference

points for shaping their findings about whether AfL is considered to be worthwhile assessment practice, i.e., “assessment for learning is important for enhancing student learning and achievement.” (Cooper & Cowie, 2010, p. 979). There is synergy between the perspectives and purpose of AfL by Black et al (2004, 1998), Sadler (1989) and the Assessment Reform Group (2002)

Principle 1: the need for effective planning and organisation by the teacher

Research from the New Zealand based team; Cooper and Cowie (2010) suggested that in order for AfL to be implemented effectively in a Geography education context, time spent by the teacher on planning and organising learning activities using best-practice Geography methodology was required. In the Cooper & Cowie (2010) study, the teacher wanted his Geography teaching to help students develop their critical thinking skills and ability to ask and respond to complex questions. When teacher lesson planning included the provision of time to communicate with students about learning outcomes for the lesson, and when he also provided them with the opportunity to develop marking criteria, it was found that students were better able to demonstrate higher order thinking skills. As a result of better planning, students achieved improved learning outcomes and the teacher's lesson preparation and organisation was deemed more effective. From the teacher's perspective, effective planning facilitated improved judgement about student progress and therefore enabled him to make more appropriate adjustments to teaching and learning programs compared to previously. It also enabled the teacher to respond to research about geography methodology and AfL.

Similarly, a United Kingdom based research team; Mavroudi and Jons (2011) also wanted to ascertain the effectiveness of AfL in a Geography education context through exploring the effects of a teacher putting more time and effort in to planning and organising lessons. Whilst the explicit focus was on providing the opportunity for students to deepen their learning about Geography, which is slightly different to that of Cooper & Cowie (2010), it can be argued that deep learning occurs as a result of critical thinking, and in a Geography context, being able to develop, investigate and respond to geographical questions. The Mavroudi and Jons (2011) study was focused on the author's own Geography class in a higher education context. By ensuring her planning and organisation of lessons included active and inquiry based learning components to the unit of work and assessment task, the different learning needs of the students were catered for;

students extended their learning; she was able to respond to research about Geography methodology and formative assessment. Therefore, deep learning was said to have occurred amongst her students.

There is a close connection between the focus of Cooper and Cowie (2010) and Mavroudi and Jons (2011) research even though their Geography education context is slightly different: critical thinking, school based; and deep understanding, higher education respectively. Consensus was reached between these research teams in response to whether AfL practices were implemented effectively in a Geography education context through more explicit time being spent by the teacher on lesson preparation and organisation.

Principle 2: the role, provision and quality of feedback

Research from Birenbaum, Kimron and Shilton (2011) based in Israel, suggested that in order for AfL to be implemented effectively in a Geography education context, there needs to be opportunities for students to provide feedback to each other about their work and establish how to progress their work. Whilst this is also considered to be peer assessment, Birenbaum, Kimron and Shilton (2011) propose that AfL is improved and becomes most effective in response to 'feedback'. i.e. feedback from teacher-to-student, feedback from student-to-teacher, and also feedback from student-to-student. This research team did not refer to peer assessment as such and they were researching the influence of feedback on AfL practices across a range of subjects from primary to secondary school. Birenbaum, Kimron and Shilton (2011) also discovered that the importance placed on the role, provision and quality of feedback is connected to the emphasis on professional learning and desire to change classroom assessment culture towards formative practice.

Also researching a variety of subjects across a primary and secondary school setting but this time in New Zealand, Dixon, Hawe and Parr (2011) likewise focused on the role, provision and quality of feedback in enhancing AfL practices. Whilst this research was concentrated more towards teacher beliefs about formative assessment approaches rather than the actual provision and use of feedback, there was consensus between the Israeli and New Zealand teams that quality feedback is essential for effective AfL to occur. Additionally, the research from Dixon, Hawe and Parr (2011) found a correlation between teachers who were open to or had already adopted formative assessment approaches and the importance they placed upon providing and using feedback to inform teaching.

Assessment for Learning in the Geography classroom

There are similarities between the two research studies explored above. Overall, consensus was reached about the importance of the role, provision and quality of feedback shaping practice by teachers and therefore being an integral component of AfL in the classroom and across the school.

Principle 3: is AfL an effective formative assessment strategy?

An Australian research team, Thompson, Pilgrim and Oliver (2005) acknowledge initially that a mix of learning approaches is required in order for deep-holistic learning to occur but they do not agree with formative assessments being used as a method for recording 'formal marks'. In their study about the effectiveness of self-assessment and reflective learning being used as a way encouraging more students continue with their study of Geography at University, and become independent learners with well-developed critical thinking skills, Thompson, Pilgrim and Oliver (2005, p. 415) suggested this was "misguided.. and there is little point in developing formative assessment as it encourages students to adopt surface instead of deep approaches to learning." The Australian team propose that self-assessment may be a formative and assessment for learning technique but it is not a worthwhile approach to pursue due to the gap between student perception of their own work and teacher/lecturer perception of their work, thus formative approaches should definitely not be used for formal marks or reporting. It was interesting to note that this team was one of the few who did not reference the work of Black et al (1998, 2004) or Sadler (1989), and they came up with fairly oppositional results about AfL compared to the other research teams.

At the other end of the spectrum was the New Zealand team Dixon, Hawe and Parr (2011). As indicated previously, they were working across subjects in primary and secondary education settings to ascertain what effective AfL looks like. Part of their study indicated that effective AfL in the classroom was focused on quality feedback, another section of their study proposes that effective AfL lies in the fact that it is a formative assessment approach which requires teachers to work collaboratively with students in determining their learning outcomes, activities and assessments. This ties in to the provision of constructive, quality feedback.

There is consensus about AfL being part of formative assessment but the Australian and New Zealand research teams did not reach consensus about formative assessment (including AfL strategies)

being effective. The New Zealanders were very 'for' formative assessment approaches, of which AfL is part; the Australians were against the implementation of formative assessment practices, particularly if they were going to be used as formal marks.

Principle 4: the need for the professional development of staff

There were two New Zealand based research teams, investigating whether effective AfL approaches were related to school culture and the availability and type of professional development for staff. Cooper and Cowie (2010) were researching this in a secondary school based geography education context; Dixon, Hawe and Parr (2011) were looking at this in a primary and secondary context across a range of subjects. Cooper and Cowie (2010) suggest that professional learning takes the form of external providers in a mentoring capacity and through teachers sharing their ideas, practice and reflections within schools. Their research revealed that the effectiveness of professional development depends firstly, on individual teacher beliefs and willingness to change current practice; secondly, on the demands of summative national testing; and thirdly on support and/or permission from school leaders. Somewhat leading on from this, although not by specific design, Dixon, Hawe and Parr (2011) discovered that teachers are the main obstacle to implementing AfL practices. This exemplifies Cooper and Cowie's (2010) findings such as teacher willingness (or not) to change current practice and on support and permission from school leaders to change the culture towards AfL and related professional development opportunities. According to Dixon, Hawe & Parr (2011) within schools that have teachers who are resistant to change, professional learning should be directed towards quality teaching and reflection about the quality of their own practice, as well as the consequences of their beliefs about student learning.

Birenbaum, Kimron and Shilton (2011) from Israel put forward that when professional learning is school based, the school community will often work collaboratively and respectfully to determine and cater for their own learning needs. They also share reflective professional dialogue and work towards assessment becoming inquiry based, therefore heading towards AfL and formative assessment approaches.

Each research team reaches consensus about the importance of professional learning in shaping culture and helping support or change direction towards effective implementation of AfL practices. The Israeli team and Dixon, Hawe and Parr (2011) reach consensus

about the power and effectiveness of collaborative, sharing school based professional learning groups. However, both New Zealand research teams agree that external providers are wanted components to professional learning opportunities about AfL. Cooper and Cowie (2010) clearly state, and Dixon, Hawe and Parr (2011) allude to external providers (such as a university alliance) being desirable for helping schools to promote a pathway towards embedding AfL pedagogy in to classroom practice and therefore working towards changing school culture about 'good' assessment.

Principle 5: the role and importance of self and peer assessment

Both New Zealand based research teams were investigating the importance of self and peer assessment as part of AfL. Cooper and Cowie (2010) saw self and peer assessment being a result of effective teacher planning and organisation. Their research showed that students developed a deeper understanding of the Geography content and skills they were exposed to because they had to assess themselves and work with others to improve their understanding. Similarly, Dixon, Hawe and Parr (2011) found that self and peer assessment was required for students to become expert and autonomous learners. The flip side of this was that the execution of peer and self-assessment in classrooms was dependent on teacher beliefs and congruence between their words and practice. This links back to their findings about feedback discussed at Principle 2. For Dixon, Hawe and Parr (2011), the success of self and peer assessment was also dependent on the receipt of quality feedback.

Research from Australia via Thomson, Pilgrim and Oliver (2005) revealed that in order for students to become independent, deep learners and responsible for their own learning, a trial of a self-assessment tool was required in the lead-up to end of semester assessment and reporting. In this study, first year Geography students at University were provided with a self-assessment schedule for writing a field report based on their findings and experience of a fieldwork unit. This approach was not in common use across the University because of the emphasis on performance marks. Research results found that due to a significant discrepancy between teacher and student assessment of the required task, self-assessment and other similar formative approaches were superficial and inadequate, especially if the marks were to be used as part of formal assessment and reporting procedures.

Although not explicitly referenced in Birenbaum, Kimron and Shilton (2011), the provision and quality of feedback

between students (peer assessment) was found to be important in effective AfL,

There was consensus between all research teams that self-assessment and peer assessment should produce independent, deep learners, however, the Australian research team broke away from the group and based on the results of their research, emphatically did not agree that self-assessment was a useful and effective tool for students, particularly as a reference point for formal reports.

Principle 6: the role and importance of student-centred learning and learner autonomy

Most of the authors had research results related to the importance of student-centred learning and learner autonomy in AfL practices.

The Israeli research team, Birenbaum, Kimron and Shilton (2011) proposed that student centred learning practices were evident in schools that functioned as a professional learning community and did not see teachers as the providers of knowledge. Based on their research, for AfL practices to occur successfully, the classroom culture should be oriented towards self-regulated learning and for errors to be seen as an opportunity to advance knowledge, understanding and skills.

Although in a higher education Geography specific context, Mavroudi and Jons (2011) from the United Kingdom, discovered that the use of information and communication technologies (ICT) in assessment facilitated the development of student centred learning and learner autonomy through active inquiry based learning. This was also because students were confident in their knowledge, understanding and skill in the use of ICT, which surpassed that of their teacher; and the University had the necessary equipment which was underutilised due to lack of knowledge from staff about how to use the video cameras and software programs. The ICT task provided students with the ability to develop their imagination, organisation, communication and critical thinking skills. This relates well to the findings from the Israeli team referenced in the point above.

Dixon, Hawe and Parr (2011) from New Zealand put forward that learner autonomy is an expected outcomes of self and peer assessment. This was further discussed in Principle 5. Whilst the Australian team of Thompson, Pilgrim and Oliver (2005) agreed with this initially, their research revealed that whilst the self-assessment tool encouraged students to monitor

and measure their progress over the fieldwork report tasks, and provided them with the opportunity to have several attempts at the task before submitting a final copy, many students did not appear to take this seriously or fulfil the task to the anticipated outcome.

There was consensus overall between the authors that student centred learning and learner autonomy is the desired outcome of effective AfL but Birenbaum, Kimron and Shilton (2011) differ slightly and suggest this importance is part of a school based professional learning and classroom assessment culture, whilst Dixon, Hawe and Parr (2011) believes student-centred learning and learner autonomy is attributable to self and peer assessment.

Conclusion

Overall, the literature review has revealed a significant degree of consensus about the principles of Assessment for Learning in a Geography education context, from an international perspective. The literature spanned primary, secondary and higher education contexts, predominantly in Geography education but not exclusively. Interestingly, the Australian research team was at odds with the majority of other research teams and I propose this is in part due to the lack of synergy between the reference lists. Across the research, such as that from New Zealand, United Kingdom, United States of America, there were cited references in common although contexts and areas of explicit focus may have differed slightly. In conclusion, it can be deduced that the principles required for the effective implementation of AfL in a geography education context are: the need for effective planning and organisation by the teacher; the need for importance to be placed on the role, provision and quality of feedback; that AfL is an effective formative assessment strategy; the need to build AfL culture through the provision of professional development opportunities for staff; the need for importance to be placed on the role and implementation of self and

peer assessment; and there is a need for importance to be placed on the role of student-centred learning and learner autonomy.

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*Have you registered for the 2015 AGTA Conference –
New Zealand and the Australian Curriculum: Geography?*
Go to – agta.asn.au for conference program and registration

FastTracking the Future Education Program

Educating about local change and the North West Rail Link

Large infrastructure projects planned around transport and urban growth initiate long-term change for the local communities in which they occur. Schools can provide a direct avenue for learning about local change but there are few instances where schools and government agencies have worked together to broker education programs that explore the change dynamic.

Working in partnership with schools and teachers North West Rail Link has developed an innovative education program aimed at exploring the change dynamic, and what it will mean for schools and communities as a new rapid transit system rolls out across Sydney's North West region.

FastTracking the Future is a curriculum resource for primary and secondary teachers. It is based on authentic learning, an instructional approach that allows students to explore, discuss, and meaningfully construct concepts and relationships in contexts that involve real-world problems and projects that are relevant to the learner. It provides teachers with classroom-ready materials to explore commonly asked questions surrounding the North West Rail Link project and its legacy for local communities including: Why is a new rail network necessary for the North West? What has been involved in the planning, and now current construction of the North West Rail Link? What benefits flow from this infrastructure change?

In response to these questions, *FastTracking the Future* surveys the unique historical and geographical identity of the North West as a major urban growth area, examines the reasoning behind the design and construction of the rail line and investigates how this project will transform the region.

The resource consists of printed and online publications of primary and secondary teaching and learning books comprising unit and lesson plans, source materials and worksheets. Books and lessons can be downloaded in PDF format. All units and lessons are linked to Board of Studies NSW Australian Curriculum-based syllabuses in terms of subject area and learning across the curriculum content.

Teachers can access all of the resources from the education section of www.northwestrail.com.au or <http://nwrail.transport.nsw.gov.au/Education>.



For Geography teachers

FastTracking the Future provides lessons and resources for primary HSIE and secondary Geography teachers. The primary materials are structured around core concepts underpinning the HSIE K-6 Syllabus and address issues related to the environment and sustainability. The secondary materials address key topics covered at Stages 4 and 5 concerning community development and change. Both the primary and secondary lessons offer students the opportunity to explore features of planned change in their local area while developing an understanding of what the North West Rail Link will mean for the people and communities of Sydney's North West region. Lessons focus on building geographical literacy skills, engage students with a wide range of sources and scaffold enquiry-based approaches to teaching and learning.

Teachers can access all of the resources from the education section of www.northwestrail.com.au (www.nwrail.transport.nsw.gov.au/Education).

FastTracking the Future Education Program

Get your school involved

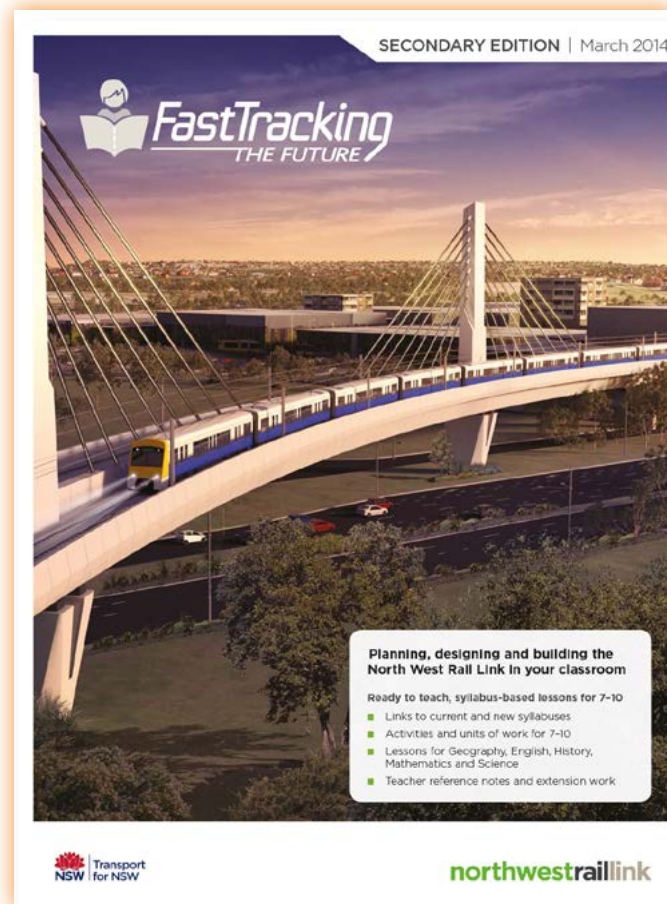
There are a number of ways your school can become involved and participate in *FastTracking the Future* activities.

The Lighthouse Schools Program

The Lighthouse Schools Program is open to schools in Sydney's North West interested in implementing the *FastTracking the Future* resources. It will allow schools to trial the program with support from the North West Rail Link. The aim of the Lighthouse Schools Program is to determine how these resources can be integrated effectively into the school curriculum and identify best practise teaching and learning resources.

Teacher professional development days

It is intended that implementation ideas and approaches gathered from the Lighthouse Schools program will be shared at primary and secondary regional workshops scheduled for Term 4, 2014.



Excursions and incursions

Members of the North West Rail Link project team are available to talk to students at your school about various aspects of the project. We have technical or general speakers who can come and talk to your students about key aspects of the project. We also assist with excursions focusing on the project.

If you are interested in involving your school in any of these activities you can email us at – education@northwestrail.com.au.



ATTENTION – ALL GEOGRAPHY TEACHERS



Geography Teachers' Association of NSW **ARTHUR PHILLIP AWARDS**

ENTRIES NOW OPEN FOR THE 2014 GEOGRAPHY FIELDWORK COMPETITION

The Geography Teachers' Association of NSW (GTA NSW) organises an annual competition for students and schools to foster an enthusiasm for Geography through engagement and rewards. The emphasis of the competition is fieldwork and the gathering of primary data as part of authentic research in geography.

The competition is open to all secondary schools, both members and non-members of GTA NSW.

All categories of the competition are based on the research action plan outlined on page 17 of the Years 7–10 Geography syllabus. The steps of this research plan have also been applied to the senior Geography course for the purposes of this competition and fit neatly with the Senior Geography Project.

Competition entries to be received by Friday 28 November 2014

COMPETITION CATEGORIES:

1. The GTA Fieldwork and Visual Presentation Competition for Years 7–9
2. The Global Education Research (Fieldwork) Competition for Years 7–12
Three categories: Stage 4, Stage 5, Stage 6
3. The Dr Don Biddle Issues in Australian Environments Fieldwork Competition for Year 10 only
4. The Brock Rowe Senior Geography Project Fieldwork Competition for Year 11 only.

**To find out more about the 2014 Arthur Phillip Geography
Fieldwork Competition and to download Student Entry forms go to:**

www.gtansw.org.au

BENEFITS OF GTA NSW MEMBERSHIP

The Geography Teachers' Association of New South Wales (GTA) is a not-for-profit, incorporated body that represents the professional interests of Geography teachers in NSW and Geographical Education more generally. The objectives of the Association are to promote the study and teaching of geography in schools by:

- providing professional learning opportunities for teachers of Geography;
- advocating the interests of Geography teachers on matters in the State and National interest;
- providing forums where teachers of Geography and the wider community can exchange views;
- supporting Geographical Education through the development and dissemination of geographical resources; and
- promoting geographical research and fieldwork.

The GTA seeks to address its objectives via a yearly program of activities and events, which include:

- online publication of the quarterly Geography Bulletin a quality, peer-reviewed journal designed to serve the contemporary interests of Geography teachers and students.
- delivering Teacher Professional Learning Workshops and in metropolitan and regional locations, focussing on current issues, including in Global Education, the use of technology in the classroom, research and fieldwork skills.
- conducting an Annual Conference with keynote addresses from leading geographers on contemporary and emerging geographical issues as well as more practical sessions by geographical practitioners.
- hosting School Certificate and Higher School Certificate Reviews for teachers of Geography. These reviews are held in a number of regional areas across the state.

For further information about GTA NSW activities and events go to: www.gtansw.org.au



MEMBERSHIP RENEWAL/APPLICATION FORM 2015

ABN 59 246 850 128 – This form will become a tax invoice when completed, GST included.

Please select **ONE** of the following membership options and complete the details

☐ Personal membership \$90.00

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Surname: Given Name(s):

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Title – please tick: ☐ Head of HSIE ☐ Head Teacher of Social Science ☐ Head Teacher of Geography
☐ Co-ordinator of Geography ☐ Senior Geography Teacher ☐ Librarian

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Fax: Email:

School:

PAYMENT:

Membership is for twelve months commencing in January. If payment is made later in the year all back copies of *Geography Bulletin* will be forwarded. A membership reminder will be sent in December.

Please make cheques payable to: Geography Teachers' Association of NSW Inc

OR

Charge \$..... to my credit card: ☐ Mastercard ☐ Visa

Card Number: / / / Expiry: /

Name on card: Signature:

Post this form and your payment to: GTA NSW, PO Box 577 Leichhardt, NSW 2040

ADVICE TO CONTRIBUTORS

Editorial policy attempts to:

- promote material which will assist the study and teaching of geography
- encourage teachers to share their ideas on teaching geography
- provide a means by which teachers can publish articles
- inform readers of developments in geographical education

Articles are sought reflecting research and innovations in teaching practices in schools. From time to time issues of the Bulletin address specific themes.

Refereeing

All suitable manuscripts submitted to the Geography Bulletin are subject to the process of review. The authors and contributors alone are responsible for the opinions expressed in their articles and while reasonable checks are made to ensure the accuracy of all statements, neither the editor nor the Geography Teachers' Association of New South Wales Inc accepts responsibility for statements or opinions expressed herein.

Books for review should be sent to:

Mr John Lewis, Review Editor,
The GTA NSW Office
PO Box 577
Leichhardt NSW 2040

Deadlines for articles and advertising

Issue 1 – 1 December	Issue 2 – 1 March
Issue 3 – 1 May	Issue 4 – 1 August

Notice to Advertisers

'Geography Bulletin' welcomes advertisements concerning publications, resources, workshops, etc. relevant to geography education.

FULL PAGE (26 x 18cm) – \$368.50
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1. **Objective:** The Geography Bulletin is the quarterly journal of the New South Wales Geography Teachers' Association, Inc. The role of the Geography Bulletin is to disseminate up-to-date geographical information and to widen access to new geographic teaching ideas and methods. Articles of interest to teachers and students of geography in both secondary and tertiary institutions are invited, and contributions of factually correct, informed analyses, and case studies suitable for use in secondary schools are particularly welcomed.

2. **Content:** Articles, not normally exceeding 5000 words (no minimum specification), should be submitted to the Editor at the following address:

PO Box 577, Leichhardt, NSW, 2040

Articles are welcomed from tertiary and secondary teachers, students, business and government representatives. Articles may also be solicited from time to time. Articles submitted will be evaluated according to their ability to meet the objectives outlined above.

3. **Format:** Original in Word format on disk (or forwarded electronically via email attachment) plus one hard copy should be submitted. Tables should be on separate pages, one per page, and figures should be clearly drawn, one per page, in black on opaque paper suitable for reproduction. Photographs should be in high resolution digital format. An indication should be given in the text of approximate location of tables, figures and photographs. Every illustration needs a caption. Photographs, tables and illustrations sourced from the internet must acknowledge the source and have a URL link to the original context.

4. **Title:** The title should be short, yet clear and descriptive. The author's name should appear in full, together with a full title of position held and location of employment.

5. **Covering Letter:** A covering letter, with return forwarding address should accompany all submitted articles. If the manuscript has been submitted to another journal, this should be stated clearly.

6. **Photo of Contributor:** Contributors should enclose a passport-type photograph and a brief biographical statement.

7. **References:** References should follow the conventional author-date format:

Abbott, B. K. (1980) *The Historical and Geographical Development of Muswellbrook* Newcastle: Hunter Valley Press.

Harrison, T. L. (1973a) *Railway to Jugiong* Adelaide: The Rosebud Press. (2nd Ed.)

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8. **Italics** should be indicated by underlining.

9. **Spelling** should follow the Macquarie Dictionary, and Australian place names should follow the Geographical Place Names Board for the appropriate state.



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