Fires Burn more Fiercely as Northern Forests Warm

Dylan Walsh
(Environment 360 Reporter)

From North America to Siberia, rising temperatures and drier woodlands are leading to a longer burning season and a significant increase in forest fires. Scientists warn that this trend is expected continue in the years ahead.

When the wildfire reached Jon Cummings' backyard last summer, it had already traversed 50 miles of rugged terrain in Idaho's Salmon-Challis National Forest. Thick smoke dimmed daylight and embers sailed on hot currents. While fire-fighters were able to preserve Cummings' house and property, his neighbours up the river were less fortunate. "No houses burned, but when those folks came home it was a total moonscape," he said. Wildfires last summer burned more than 3.6 million hectares across the U.S., predominantly in the West and Southwest. Only two other times in the past 50 years have fires burned so extensively: first in 2006, then again in 2007. Twice more in the last decade fires fell just short of claiming this much acreage. Increasingly, forestry experts say this ominous trend bears the fingerprints of climate change: As average air temperatures rise and water evaporates more rapidly from vegetation and soil, the parallel rise in precipitation needed to offset these changes has not kept pace. Most models predict the deficit will only worsen in years to come.

"The initial signs of climate change — they're here," says Amber Soja, a senior research scientist at NASA who studies the interaction of fire and climate. "We have evidence in our wildfires."

In the Rocky Mountains, reduced snowpack in winter, earlier melting in spring, fewer inches of rainfall, and warmer autumns are all contributing to a fire season that has lengthened by nearly 80 days in the last three decades, researchers say. The duration of individual fires has also jumped, from an average of one week to five weeks. Anthony Westerling, a fire specialist at the University of California, Merced, and an expert on fires in the U.S. West, notes that intensifying aridity in the Rocky Mountains as the region warms will exacerbate the problem. "There is going to be a huge percentage increase in burned area that we've only just begun to see," he said.

Similar changes are emerging around the world, researchers note, most notably in the boreal forests that stretch across the northern latitudes from Alaska east through Siberia. In Canada, the average amount of land burned annually by wildfires has doubled since the 1970s, according to Mike Flannigan, a professor of wildland fire at the University of Alberta.

"And we expect another doubling to quadrupling of fire over this next century," said Flannigan. "We attribute this — and I'll be quite clear — to human-caused climate change."

In Russia, where Soja focuses her research, the figures have also ratcheted up. A bad fire season now burns tens of millions of acres. Just last year, a record 30 million hectares were consumed by wildfire, largely in the taiga of eastern and central Siberia. "It's about time we change our definition of normal, because there is just so much burning in Russia," she said. But growth in the number of acres burned is not all that defines wildfire severity. Of equal concern is the depth to which many fires now reach, pushing farther underground into parched soils.

This is especially problematic in the boreal forests, which store more than 30 percent of the world's terrestrial carbon, much of it bound in peat bogs — essentially carbon-rich mosses that have accreted, layer upon layer, over millennia. As these bogs dry out and become more flammable, wildfires bore farther down, releasing much more carbon than a conventional forest fire.Flannigan pointed to a 2002 study of particularly severe peat fires in Indonesia in 1997 that released the carbon equivalent of an estimated 20 to 30 percent of that year's global greenhouse gas emissions. "But the peat Boreal forests could be contributors to global warming rather than mitigating forces against it. reserves in the boreal dwarf those of Indonesia," he said. "If these go, emissions from the Indonesian fires would be a drop in the bucket."

These changing conditions put northern forests at risk of being transformed from repositories, or sinks, of carbon, to overall sources of CO_2. The forests would then be contributors to global warming rather than mitigating forces against it. The shift from carbon sink to source has already been documented in British Columbia: A 2008 analysis published in Nature concluded that, since 2003, fires and unprecedented tree death from bark beetle infestations had turned almost 388 000 square kilometer of forest in the province — an area the size of Montana — into a source of carbon dioxide emissions. All of Canada's vast forestland now sits precariously on this fulcrum, and may soon emit more carbon than it sequesters, according to the Canadian Forest Service.

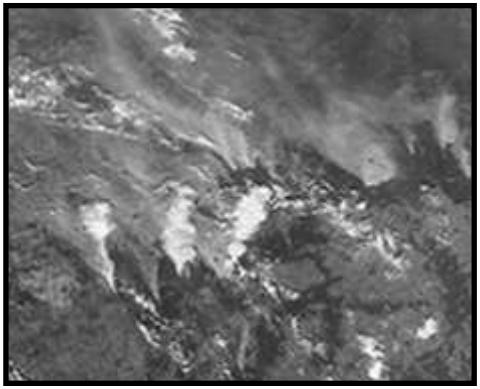
While forest regeneration would normally help to counterbalance these emissions, ecosystem shifts under the pressure of climate change are now casting uncertainty on this cycle. In a process called "green desertification," for instance, grassland steppe across Russia is replacing taiga in the aftermath of severe fires; the standard mix of conifers and hardwoods that constitute the taiga show no signs of returning. "It's likely that the entire 21st century will be dominated by these transition effects," says Westerling, who has observed similar changes in the western U.S. "Places where these fire disturbances are increasing dramatically are going to look very different in the near future." The health effects of severe wildfires also present a growing concern, particularly as populations expand along forest fringes.

Insurance giant Munich Re estimated that particulate matter and "toxic smoke" from Russia's 2010 wildfires, combined with record temperatures, accounted for an additional 56,000 deaths in July and August of that year, most of these in Moscow. And last year a program manager with the Idaho Department of Health and Welfare declared an air quality "crisis" in the small town of Salmon, near Jon Cummings' property. This year, like last, the U.S. Forest Service forecasts persistent drought and elevated fire risks across the western and southern U.S. "We anticipate 2013 to be another challenging year to manage fire," said Tom Tidwell, chief of the Forest Service, in a February 20 memo.

For most of the 20th century, the U.S. Forest Service pursued an aggressive agenda of fire suppression that allowed forest understory — which in earlier eras had been routinely thinned out by fires — to grow thick and fuel more intense blazes. "Forest ecosystems have evolved with fire," explains Keith Konen, a silviculturist for the Forest Service in Montana. "Through 100-plus years of fire suppression this natural process has been altered." In 1995, the Forest Service established a new fire policy, which recognized that "wildland fire, as a critical natural process, must be reintroduced into the ecosystem." Since then, in an effort to remove understory growth, the Forest Service has allowed fires in some federal forests to burn out on their own. Today, however, climate change has further complicated the Forest Service's job: The agency must oversee the continued use of fuel-culling fires at a time when a warming climate makes controlling these fires riskier, says Scott Stephens, a professor of fire sciences at the University of California, Berkeley. Currently, 26 million hectares of Forest Service land — or one-third of the agency's total holdings — remain at high or very high risk of catastrophic wildfires due to the buildup of fuel. Only a small fraction of this buildup is managed or removed through timber harvesting and fire in a given year.

Under a new planning rule introduced last year, the Forest Service is drawing up management plans for individual national forests that incorporate new science on climate change and fire suppression. Stephens said Forest Service officials are increasingly shying away from mechanical thinning of forests and prescribed burns, in favor of allowing naturally occurring fires to burn in a controlled manner to eliminate thick understory. "Fire management is being funded now to emphasize the resource benefits of lightning fires," said Stephens. He expressed guarded optimism that the Forest Service's new policies will help reduce the severity of fires in the American West. "I think [they] have the potential to get things done at scales that make a difference and reduce the trend of large fires," he said. But other researchers are skeptical. A 2009 study of the boreal forest published in Global Change Biology and coauthored by Flannigan reflects the prevailing sentiment: "There may be only a decade or two before increased fire activity means fire management agencies cannot maintain their current levels of effectiveness," write the authors.

Intensifying wildfires, coupled with austerity budgets that have reduced firefighting capabilities, are a global problem. Soja, the NASA fire expert, said that budget cuts in Russia have led to reduced firefighting capabilities since the early nineties. "It's just not possible for Russia, for the Canadians, to manage these large fires," Soja said. Westerling says that the same may be true of the U.S.



"There may be only a decade or two before increased fire activity means fire management agencies cannot maintain their current levels of effectiveness"

"We just have nothing like the resources you would need to treat these areas on an ongoing basis," he said, referring to the logging, thinning of understory, or controlled burns that can lessen the intensity of forest fires. The Forest Service's fire prevention and suppression funds have been slashed by more than $500 million, or about 15 percent, since 2010. "Fires are simply going to be reintroduced by nature, augmented by climate change," he said. "I think the land's going to burn, and then we'll go from there."

Land Issues

Adopted from: Monitor - A briefing sheet to keep communities informed about what is happening in Parliament

Parliamentary Monitoring Group

The Portfolio Committees overseeing the Departments of Rural Development and Land Reform (DRDLR) and Agriculture, Forestry and Fisheries (DAFF) have, over the last few months, criticised several aspects of the work of these departments. Both committees have cited lack of cooperation from officials and lack of reports, and both have questioned if the departments are capable of delivering on their targets, given lack of capacity and skills, and insufficient monitoring. MPs lambasted DRDLR for promising to attend to redistribution, yet not specifying where and when this was done. DAFF was questioned how it spent 99% of its funds, but achieved only 51% of targets, and MPs demanded full explanations on spending, support to emerging farmers, and seed and tractor distribution. There has been ongoing concern from many committees as to whether emerging farmers are being properly assisted to get access to markets. There is also a wider problem around lack of subsidies to local farmers (particularly when compared to heavy subsidies in other countries) and insufficiently protective import tariff arrangements, which make it cheaper for retailers and food manufacturers to import foodstuffs than to buy from local producers.

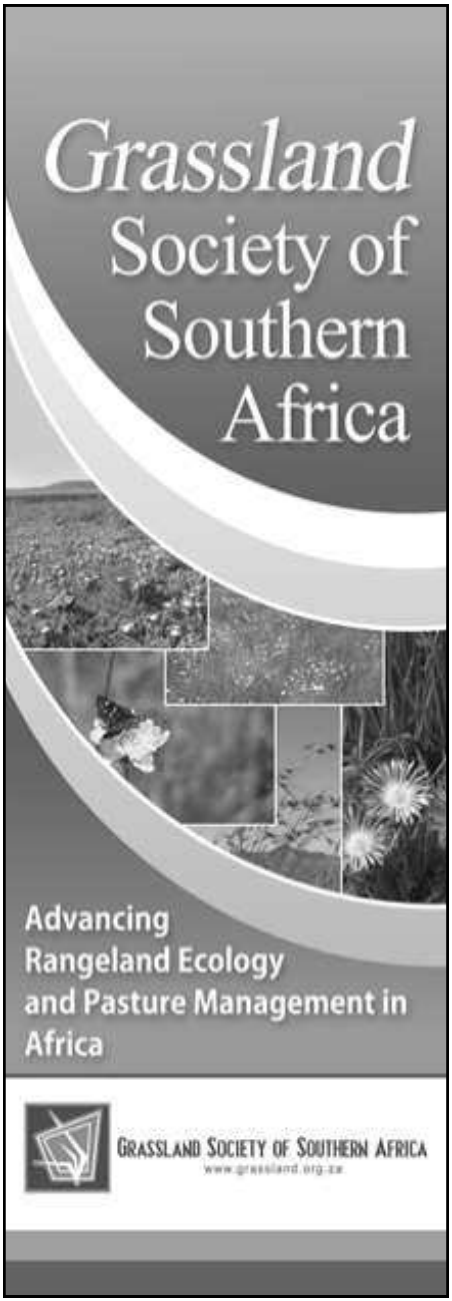
Parliament has also complained that the Land Claims Commission has only reported once to Parliament since 1994, despite substantial budget allocations being shifted to this programme recently.

Parliament is planning a major campaign in June - which marks one hundred years since the passing of the Native Land Act of 1913 – to highlight the initiatives of the democratic government to reverse the apartheid legacy. All political parties are unanimous on the need to return land to rightful owners. To date, only 8% of the land has been redistributed. South Africa is also under an international treaty obligation to ensure that 17% of its total land estate is put under conservation by 2020. It will not meet this target, nor the target to have 30% redistribution of white -owned agricultural land by 2014.

Although the problems in land redistribution have often been ascribed to the willing-buyer, willing-seller principle, and lack of state money to purchase land, opposition parties have pointed out that substantial land owned by government has not been fully identified and redistributed, which points to state officials not getting to grips with the situation.

Government intends to re-open the land claims process, particularly to allow claims from the Khoi and San people, whose land (and heritage artworks) have been incorporated into farms, and to others who missed the first deadline. However, there is concern whether government will be able to cope with a new influx of claims, particularly since past experiences showed a number of fraudulent claims. Provincial legislature meetings, workshops and public meetings on land issues will be held in [June 2013].

In an official report, The Department of Agriculture, Forestry and Fisheries (DAFF) is calling for interventions to cushion farmers and ensure that farm workers and communities will not be left destitute after the recent farm wage increases. The Minister of Agriculture said the disputes resulted from structural shortcomings that included the decline in the number of commercial farmers, farmers consolidating enterprises to maximise profit, an ageing farm population, struggling small-holder farmers, limited support, and diminishing agricultural skills. All of this was exacerbated by the global financial crisis and high internal costs of fuel and energy, as well as government's minimal support to the agricultural sector. DAFF is considering new plans to assist smallholder farmers to become commercial farmers, negotiating better rates with LandBank, and working on youth employment. It is discussing with the Department of Labour, whether sectorial negotiations or collective bargaining may be more suitable for farm workers meetings on land issues will be held in [June 2013].



Academies of Science Urge Action on Global Challenges

ASSAf

The Academy of Science of South Africa (ASSAf) is one of 14 national science academies to issue a joint call to world leaders to address two of the most pressing global challenges; drug-resistant infectious agents and driving sustainable development, through the use of science, technology and innovation. The joint statements are intended to serve as recommendations to the forthcoming annual G8 Summit in Northern Ireland in June this year. Drug resistance in infectious disease agents is spreading rapidly and is increasingly posing a global threat to humanity.

The current situation is becoming serious with an increasing incidence of detection of resistance to all known drug treatments, especially amongst bacteria. The statement highlights two examples - the incidence of multi-drug resistance (MDR) in Mycobacterium tuberculosis, which can result in untreatable tuberculosis infection. MDR is rising steadily worldwide. According to a recent WHO report, an estimated 440 000 cases of MDR tuberculosis were notified worldwide in 2011. Furthermore, 84 countries have reported untreatable tubercular infection.

The second example is that of common bacterial infections caused by Enterobacteria in hospital settings. Carbapenem-resistant Enterobacteriaceae (CRE) infections are on the rise, and have recently become resistant to 'last-resort antibiotics'. These bacteria are an increasing cause of mortality in many countries. According to a WHO Report the "world is heading towards a post-antibiotic era in which many common infections will no longer have a cure and once again kill unabated".

The resistant organisms are often very difficult to treat. They impose great health risks to individuals and significant costs to society. The academies recommend several actions to reduce the burden of drug resistance to improve global health and to enhance economic well-being.

- Information and education programmes on a more responsible approach to drug prescription for human use.
- Promote integrated global surveillance systems.
- Encourage pharmaceutical companies to develop new antimicrobials.
- Equip developing countries to be a partner in the fight against emerging antimicrobial drug resistance.

In the statement Driving Sustainable Development: the Role of Science, Technology and Innovation, the academies set out perspectives on how science technology and innovation can play a role in ensuring sustainable development against a growing world population, projected to reach 9 billion by 2050. Challenges that are being globally faced are demographic changes, growing urbanisation and providing for the needs of 9 billion people. The wellbeing and social contributions of a growing number of elderly people require special attention and innovations will be necessary if advanced healthcare and valuable societal roles for all are to be provided. The strains brought about by unplanned urbanisation, such as adequate housing and sufficient resources like water, energy sanitation, transport, health care and waste disposal, will likewise require investments in research, innovative new approaches, as well as behavioural changes.

While emphasising the need for action by governments to ensure water availability and adequate nutritious food, the academies call for a range of clean, renewable energy options to provide energy without unacceptable environmental impact. The academies recommend universal promotion of literacy, especially among women, and refer to inquiry-based education as a promising approach to improving education systems.

The statement underscores the role academies of science can play in promoting science, technology and innovation. They, inter alia, pledge to:

- Provide a source of independent, objective expertise, bringing scien tific rigour to gathering evidence, including what is known and not known, which ultimately underpins progress towards sustainable devel opment.

- Collaborate across academies to raise visibility and capacity to pro actively engage with the sustainable development policy community at national, regional and international levels.

- Promote multidisciplinary research for a holistic approach to sustainable development, including engagement with the private sector.

- Improve public awareness of the role of science, technology and in novation can play in promoting sustainable development.

ASSAf
ACADEMY OF SCIENCE OF SOUTH AFRICA

Global Warming: Man or Myth?
Climate Change Impact on Grasslands & Savannas

According to the IPCC (2007), temperate grasslands are important for maintaining soil stability and carbon storage and they also provide food for wild and domestic animals. Tropical savanna systems possess significant wild animal diversity that supports tourism revenue and subsistence livelihoods (food, medicinal plants, and construction material), in addition to cultural, regulating and supporting services. These ecosystems appear to be more sensitive to climate change than previously thought. Ecosystem function and species composition of grasslands and savanna are most likely to be impacted by changes in precipitation and by warming in temperate regions while in tropical systems, CO_2-fertilization and fires will be very important controlling factors. Unfortunately, there are very few studies that assess ecosystem responses to these various factors and experiments on warming, rainfall change or atmospheric CO_2 level are virtually absent in savannas. Most ecosystem studies are confined mainly to temperate grasslands (IPCC, 2007). The IPCC (2007) describes the following impacts:

- Rainfall change and variability is very likely to lead to a reduction in cover and productivity in the southern African savanna in response to the observed drying trend of about 8 mm/yr since 1970.

- Large-scale changes in savanna vegetation cover may also result in a feedback to regional rainfall patterns. Modelled removal of savannas from global vegetation cover has larger effects on global precipitation than for any other biome and, in four out of five savannas studied globally, modelled savanna-grassland conversion resulted in 10% lower rainfall, suggesting positive feedback between human impacts and changing climate.

- Canadian grasslands stored roughly five times as much carbon in a year with 30% higher rainfall, while a 15% rainfall reduction led to a net carbon loss. Similarly, Mongolian steppe grassland switched from carbon sink to source in response to seasonal water stress.

- Trees and shrubs show higher CO_2 responsiveness than do herbaceous forms. Savannas may thus be shifting towards greater tree dominance as atmospheric CO_2 rises, with diminishing grass suppression of faster-growing tree saplings. Climate change impact studies for savanna and grassland fauna are few. The proportion of threatened mammal species may increase to between 10% and 40% between 2050 and 2080.

According to Scheiter and Higgins (2009), African savannas are characterized by C_4-grasses and C_3-trees. An increase in CO_2 might favor trees over grasses due to potentially larger benefit that C_3-plants would gain over C_4-plants (IPCC, 2007). On the other hand, an increase in temperature would increase rates of C_4-photosynthesis, C_3-photorespiration and evaporative demand. Each of these temperature-driven factors might directly (or indirectly by promoting fire) favor grasses (Scheiter & Higgins, 2009).

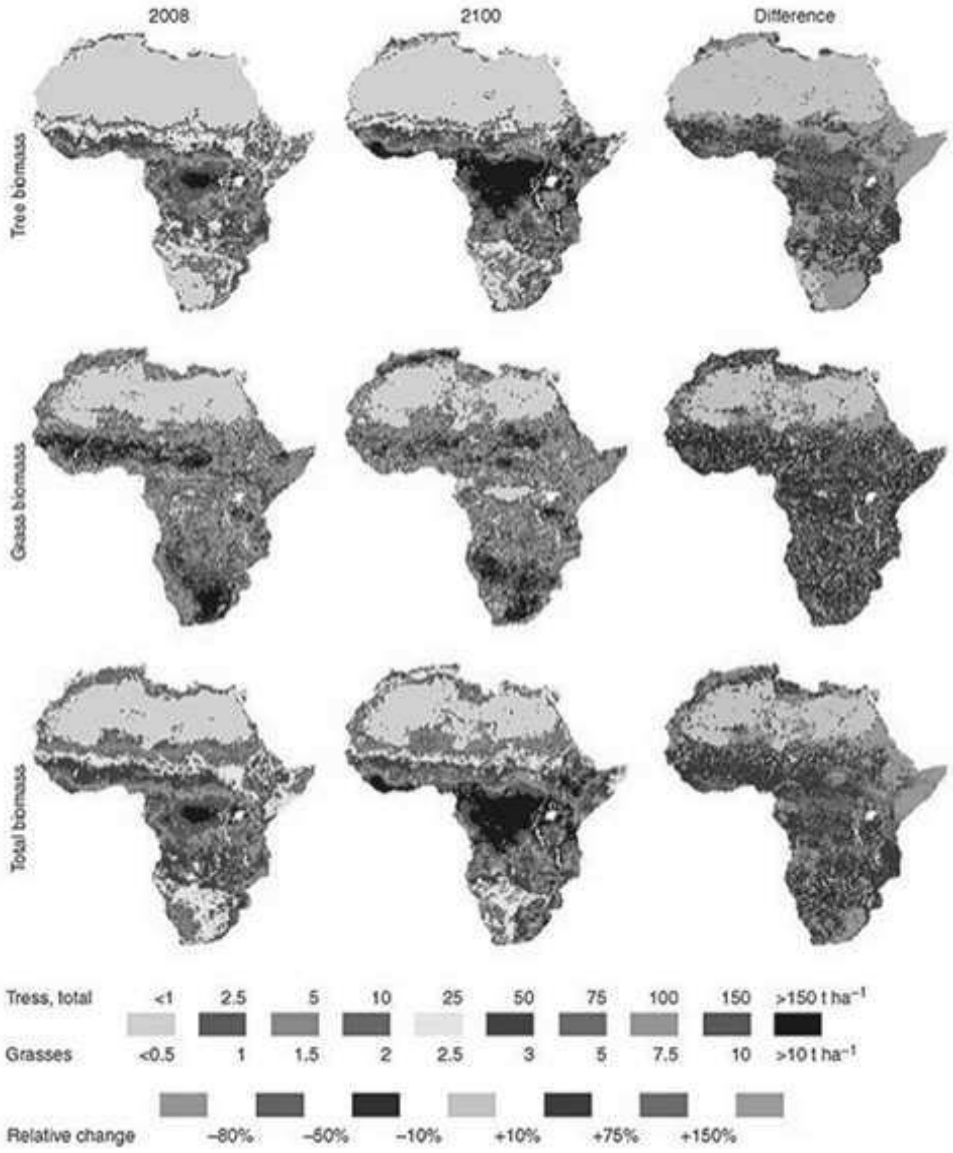
The authors presented a new vegetation model, the adaptive dynamic global vegetation model (aDGVM) specifically developed for tropical vegetation, to simulate the vegetation patterns of Africa in the year 2100 under projected increasing CO_2 levels. Simulations under elevated temperature and atmospheric CO_2 concentrations predicted longer growing periods, higher allocation to roots, higher productivity, more biomass and a dramatic shift toward tree dominated biomes. As shown in the figure below, the model predicts that large parts of today's savannas will be replaced by deciduous woodlands under elevated CO_2 conditions. It is predicted that 34.6% of today's grasslands are transformed into savannas and 45.3% of today's savannas are transformed into deciduous woodlands. The fraction of deciduous woodlands is predicted to increase by 13.2% to 26.9% while the savanna biome is predicted to decrease by 6.1% to 19.7%. The total biomass stored in each of the biomes increases, with high relative changes in grasslands and savannas (by 256% and 241%, respectively).

The absolute changes are 420 Pg for savannas, deciduous woodlands and evergreen forests. These changes together imply that the total carbon stored in trees in Africa increases from 74.9 Pg in 2008 to 151.7 Pg in 2100, a difference of 76.8 Pg. (Note: 1 Pg = 1 billion metric tons)

The authors are also careful to note that their study considers the influence of climate on vegetation while it does not account for the fact that vegetation modifies the climate. It is known that the feedbacks between climate and vegetation might significantly influence vegetation. According to the IPCC (2007) modelled removal of savannas from global vegetation cover has larger effects on global precipitation than for any other biome and, in four out of five savannas studied globally, modelled savanna-grassland conversion resulted in 10% lower rainfall, suggesting positive feedback between human impacts and changing climate.

According to the IPCC (2007) the proportion of threatened mammal species may increase to between 10 and 40% between 2050 and 2080 due to the changing savanna and grassland regimes in Africa. Changing migration routes especially threaten large, hoofed animals and their predators. Observed population declines in three African savanna hoofed species suggest that summer rainfall reductions could result in their local extinction if climate change trends continue.

According to The State of the Birds 2010 Report on Climate Change (2010): "Climate change is expected to exacerbate declines in birds that already have declining populations, and several now-common birds will probably be added to concern lists in the near future unless additional conservation measures are taken." Grasslands in the United States are expected to get warmer and drier which will impact many bird species. For example, the desert southwest and northern Mexico Chihuahuan Desert grasslands may become too warm and dry for bird species that typically winter there. "Six species stand out as especially vulnerable. Sharp-tailed Grouse and Lesser and Greater prairie-chicken are less likely than other grassland birds to move in response to changing conditions because they are closely tied to their leks where males display to attract females. Wilson's Phalarope, Bobolink, and Dickcissel are long-distance migrants that may not be able to adapt quickly enough to changing conditions. Although most grassland bird species appear able to move in response to environmental changes, Christmas Bird Count data show that grassland birds were the only group of birds that failed to shift north during the past 40 years in response to warmer winter weather. Perhaps they did not shift because the quality of remaining grasslands in the north is too poor to sustain additional birds" (Ibid).


2008
2100
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3
5
7.5
10
>10 t ha⁻¹
Relative change
–80%
–50%
–10%
+10%
+75%
+150%

Journal News

Susi Vetter
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I took over from Peter Scogings as Editor-in-Chief of the African Journal of Range & Forage Science in 2008 (first as acting editor, and from 2009 as the new editor) at a time when many of his efforts were bearing fruit, including indexing in the Thomson ISI Journal Citation Reports and an online submission system. To those of us working with the journal on a daily basis, the time before these improvements seems like a distant and archaic memory. I joined the team as assistant editor in 2003, by which time email had thankfully replaced submissions by hardcopy and "snail mail", but the endless exchanges (and mushrooming folders) of emails, and record keeping in spreadsheets, seem hopelessly antediluvian by comparison with the slick system and good support we have now. For the record, I am thankful every time I do my editorial duties for how much easier my job is than that of my predecessors!

Of course it isn't just technological advances that make the job easy, and I have a fantastic team to thank for their contributions. First in line (as so often) is Freyni du Toit, our journal administrator, who holds it all together, never loses sight of the big picture, manages to nag and remind tardy authors, reviewers and editors in the nicest possible way, and just generally is the "person behind the scenes" without whom things just wouldn't happen. Our Associate Editors are a strong team and do sterling work – thanks to all of you for ensuring a fair and stringent review process. Robert McKenzie, our publishing editor at NISC, is responsible for the finished product and has been a pleasure to work with. And, of course, nothing of this would be possible without the authors who support us by choosing the journal to publish their work. I guess it is becoming obvious where this is going... thank-you speeches seldom come without a catch! Now that the "new era" is in full swing, it is time to hand on the baton.

Not that I am fatigued or fed up or otherwise keen to call it quits, but increased work responsibilities in my department will make it impossible for me to keep up the journal editing. I am very pleased that we have managed to recruit James Bennett as our new Editor-in-Chief, who will take over from July. For those of you who don't know him, James is a Senior Lecturer in Environmental Studies at Coventry University in the UK. He did his PhD research on small-scale cattle production in the Eastern Cape, where he was affiliated with the University of Fort Hare.

Much of his ongoing research is done in South Africa, where he spends regular periods doing field work. So apart from being familiar with the (South) African research context, he will bring an international perspective to publishing our journal which will hopefully help it grow and flourish. He has been part of the team as an Associate Editor and is currently guest editor of a special issue, and his broad range of expertise – covering ecological, agricultural and social aspects of rangelands, from common property management to experimental design and statistical analyses – has proven extremely valuable.

I have greatly enjoyed my ten years working with the journal and have seen it grow from strength to strength. The profile of the journal has been increasing, thanks to ISI indexing and improved marketing by our publishers, and our impact factor has grown from a humble 0.25 in 2011 to a more respectable 0.6 in 2012. With increasing submission rates and some exciting special issues in the pipeline, we expect this trend to continue, and we are aiming to achieve a profile comparable to other international rangeland journals. This will only happen if we publish good quality work and our papers are cited - so please make use of the journal as a resource in your research, cite papers from the journal where relevant, and of course keep in mind the African Journal of Range & Forage Science when next you write up a piece of exciting research!

Look out for Issue 30-1&2 (July 2013), which is a special issue on "Aligning policy with the socio-ecological dynamics of rangeland commons" guest edited by James Bennett. This will be launched at the Congress in Modimolle and will feature our new cover design!

Susi Vetter

The SA Risk and Vulnerability Atlas GeoSpatial Database

Wim Hugo
SAEON

The South African Risk and Vulnerability Atlas is complemented by a GeoSpatial Database (data portal) that is based on internationally adopted standards for data and meta-data management. The data portal supports multiple use cases identified in the development phase, including the ability of registered users to contribute their own content, and control the visibility and publication life cycle of their content.

Several content types are supported. These include simple file uploads and user-controlled web page development in addition to data uploads, meta-data definitions, blogs, news events and complex map or atlas creation. This allows collaboration, sharing and content composition facilities for the distributed creation and management of value-added themes, discussions, community pages, and more.

User community

Registered users at present include theme convenors and their collaborators, but these will soon be extended to include the wider Risk Atlas community, particularly in the emerging regional Risk and Vulnerability Assessment Centres. The infrastructure forms part of a shared platform that also hosts the data portal of the South African Environmental Observation Network (SAEON), the South African Earth Observation System of Systems (SAEOSS), the BioEnergy Atlas for South Africa, and prototype International Council for Science (ICSU) World Data System components for Africa.

The platform is based on a shared and aggregated meta-data repository capable of accepting and working with a range of well-established meta-data standards. These include Dublin Core, SANS 1878, the ISO 19115 family, EML, and FGDC. The list is likely to be extended from time to time to accommodate other standards in widespread use by a user community or new data provider, and should in future include standards widely in use in the earth and environmental observation community. One of the major benefits of this arrangement is the synergy of collective meta-data gathering and maintenance. The basic functionality allows users to search for and visualise or download data in a variety of supported formats, and these components are flexible enough to be customised for inclusion into multiple locations in the portal, as well as in external systems, delivering either open search capabilities or predefined search results to augment, for example, themes within the Atlas. Users can filter and analyse the search results to better understand the availability of data for a given topic, time period, and/or spatial extent.

International stakeholder community

The platform now also links the shared meta-data repositories contributed by South African initiatives to the Group on Earth Observations (GEO) through the GEOSS broker, exposing data sets and resources to an international audience. In broad terms, the platform and its hosted portals are designed to serve a stakeholder community as a resource for the referencing, description, discovery, management and optional archiving of relevant data sets and information objects. It also allows the composite visualisation of distributed data sets, provided that access to these sets is automated and standardised - creation of distributed maps, charts and table representations of data. The platform is currently hosted by SAEON in Pretoria, and a mirror site for test and development has been deployed to the Centre for High Performance Computing in Cape Town. The software is based on Plone, an open source content management system that has been extended to cater for the special data types required by the Atlas.

Additional visualisation tools for map and chart representations were also developed, as well as wizard-driven interfaces for map creation and data uploads.

Current and future developments include:

An ongoing programme to add new data providers and meta-data sources; Development work to accommodate large image collections, SensorWeb data downloads and visualisations, and NetCDF data sources; Implementation of distributed Web Processing Services; Implementation of 'mediation' technology, whereby distributed visualisations and processes can be persisted for future re-use; Automated linking to, and integration with online data publishing initiatives, such as DataCITE; Measures to allow remote authentication into data provider sites; and mechanisms to support data providers with detailed, service-based usage metrics of their data and meta-data.

Typical search results and analysis of search results

Using the GAP application for the SA Risk and Vulnerability Atlas

Elsona van Huyssteen and Johan Maritz
CSIR Built Environment

The Geospatial Analysis Platform (GAP) was developed by the CSIR as an evolving and collaborative initiative (in partnership with The Presidency and the Department of Trade and Industry) to support the South African planning and policy environment.

GAP can be described as a common mesoscale geospatial platform for the assembly, analysis and sharing of strategic information (e.g. demographic, economic, development and demand information). It was essentially developed to make information (map themes) available offline to provide information about:

- what is where;
- how much there is;
- where the main concentrations/hot spots are to be targeted; and
- what can be reached from where.

The application has proved its worth in packaging planning-relevant economic and environmental information, used among others by the Limpopo Economic Development Environment and Tourism Department (LEDET).

User-friendly interface

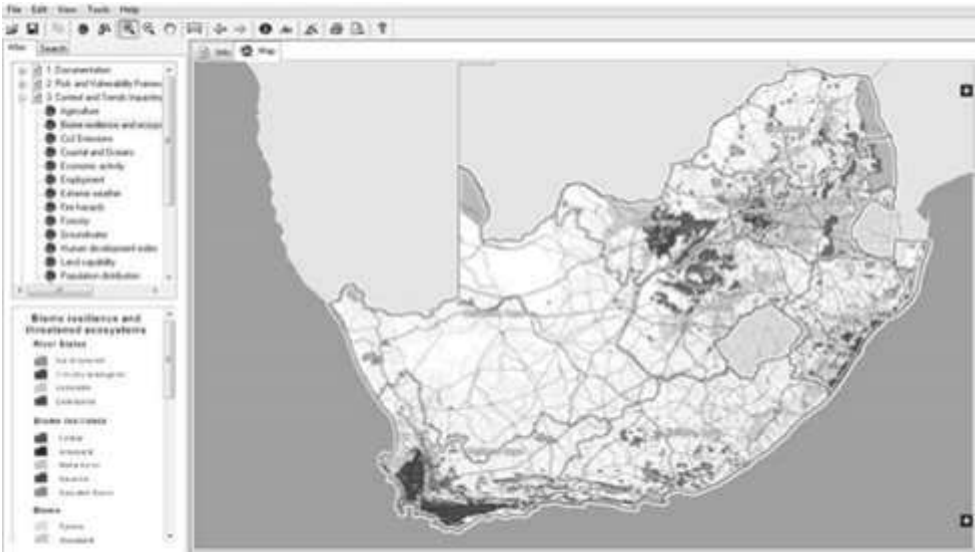
GAP serves as a user-friendly interface that displays the maps, themes as well as other non-spatial content (thus operating like a GIS data viewer). The application was recently customised to meet the needs of the Department of Science and Technology's South African Risk and Vulnerability Atlas. In addition, the South African Risk and Vulnerability Atlas toolbox includes a number of resources that offer insight into global change information, including non-spatial and more comprehensive spatial data for all user types.

The South African Risk and Vulnerability Geospatial Analysis Platform (SARV-GAP) provides an interface that easily displays a range of analyses and information that can be used by planners and decision-makers to contextualise, explore and identify risk and vulnerability of settlements and communities at municipal and regional scales.

SARV-GAP responds to questions posed by a range of municipal and other stakeholders, including:

- What are some of the most critical global change trends facing South Africa and the respective regions?
- Where are different impacts expected to be felt as a result of these changes and what are the associated risks and vulnerabilities?
- Where are the areas and communities that are potentially most vulnerable to a range of risks and hazards?
- Where are the main focus areas and priority intervention areas to be considered and integrated into disaster management, as well as integrated development planning, land use management and spatial planning processes and plans?

SARV-GAP has been developed primarily with planners and decision/policy-makers in mind. However, this tool would also potentially be useful to individuals interested in developing a better understanding of, and identifying global change risks in South Africa and at sub-national levels, including researchers, analysts, consultants, students, businesses and NGOs.



GAP Application Interface

Integrating Climate Change into Municipal Development Planning

Miriam Murambadoro
CSIR Natural Resources and the Environment

The rollout of the Let's Respond toolkit kicked off with several introductory workshops coordinated by the South African Local Government Association (SALGA). In these workshops, role-players from private and public institutions as well as universities shared the work they are doing in collaboration with local governments. The South African Risk and Vulnerability Atlas (SARVA) team was among the role-players taking part in the Lets' Respond toolkit and Guide Climate Change seminars.

Key global change issues in North West

SALGA's North West Climate Change seminar was held at Orkney. The seminar was attended by local government councillors as well as planning and environmental officials from the province. Key global change issues of concern in the North West Province include fragmented urban sprawl, which is straining bulk infrastructure. There is also an extensive occurrence of alien weeds and plant species. The Southern African Plant Invaders Atlas showed that Mafikeng alone had up to 31 alien species. Alien invasion results in replacement of biologically diverse systems with single (or mixed) species stands of aliens and alteration of hydrology. It also poses a threat to indigenous fauna.

The climate change seminar was followed by another training workshop at the SALGA offices in Pretoria. This workshop was attended by local government officials from Emfuleni, Amathole, Thulamela, Thabo Mofutsanyana District Municipality, Western Cape Department of Environmental Affairs, Vhembe District Municipality, Mangaung, Ngwathe Local Municipality, Setsoto Local Municipality, Matjhabeng Local Municipality, Free State Department of Co-operative Governance and Traditional Affairs (DCOG) and North West local government and traditional affairs.

The main objectives of the workshop included training relevant municipal staff and provincial/district government representatives from SALGA, the Department of Environmental Affairs and DCOG on how to use the toolkit to enhance municipal capacity to integrate climate change response in Integrated Development Plans (IDP) and allocate financial resources towards development projects through the regulated IDPs.

The training session was also used as a platform for learning and exchanging knowledge between municipalities and provincial/district representatives to contribute best practices for a nationwide rollout of the toolkit.

A toolkit for change

The Let's Respond toolkit seeks to assist municipalities to prepare and plan for changes in climate by providing them with the necessary steps and a set of tools to identify communities and sectors that are at risk and to explore opportunities to increase resilience. The toolkit also seeks to integrate climate change into an existing planning process rather than create a separate process altogether, given the human capital and financial constraints at municipal level. Local governments are at the helm of service delivery and also play a key role in protecting the country's social, economic and environmental assets.

However, climate change and unforeseen changes make resource management and infrastructure planning more difficult as a result of increased extreme events such as floods and droughts, runaway fires which damage infrastructure and livelihood assets, putting strain on livelihoods and increasing local government's expenditure on disaster recovery projects. The South African Risk and Vulnerability Atlas is a tool that seeks to provide local governments with all the relevant climate change information which can be integrated into their planning process so as to build their community's resilience as they strive towards sustainable development.

The Let's Respond toolkit assists municipalities to prepare and plan for changes in climate.

During the climate change workshop, participants from GIZ, Amathole District Municipality, Sustainable Energy Africa and the South African Risk and Vulnerability Atlas discuss global change issues of concern in the Amathole District.

Climate Variability, Climate Change and Global Warming
The Difference Explained

Climate variability refers to variations in climate on all spatial and temporal scales beyond that of individual weather events. This variability may be caused by natural internal processes within the climate system (so-called *internal variability*). Variations may also be caused by external influences which may be due to naturally occurring phenomena (such as periodic changes in the earth's orbit around the sun) or anthropogenic causes (IPCC 2007). One of the most important (and widely known) examples of natural climate variability is the El Niño-Southern Oscillation (ENSO).

Climate change refers to a change in the average weather experienced in a particular region or location. The change may occur over periods ranging from decades to millennia. It may affect one or more seasons (e.g. summer, winter or the whole year) and involve changes in one or more aspects of the weather, e.g. rainfall, temperature or winds. Its causes may be natural (e.g. due to periodic changes in the earth's orbit, volcanoes and solar variability) or attributable to huma (anthropogenic) activities, e.g. increasing emissions of greenhouse gases such as CO_2, land use change and/or emissions of aerosols. In contemporary society the term 'Climate change' often refers to changes due to anthropogenic causes. When changes in climate occur, they directly impact livelihoods, food security and potentially how societies, economies and political systems function.

Global warming refers only to the overall warming of the Earth, based on average increases in temperature over the entire land and ocean surface. It is important to note that climate change is more than simply an increase in global temperatures; it encompasses changes in regional climate characteristics, including temperature, humidity, rainfall, wind, and severe weather events, which have economic and social dimensions.

*Source: The Climate Risk and Vulnerability Handbook for Southern Africa

The Seed Industry as Vibrant as Ever

With 1583 participants, the 2013 ISF World Seed Congress in Athens, Greece celebrated a new record. From all continents the seed industry came together to meet in sunny Athens. The Congress provided an excellent venue for seedsmen and seedswomen to converse, learn, network and do deals. At the Opening Ceremony Mr. Tim Johnson, President of ISF underlined that ISF is a strong believer in the benefits of global movement of seeds to improve grower success around the world. Mr. Marcel Bruins, Secretary-General of ISF highlighted that in recent years services to ISF members had gone up, while the congress registration fee had gone down.

The technical meetings during the Congress were an opportunity for the industry to promote and share best practices; they acted as a forum for debate and to receive the latest updates. ISF's main goal is to facilitate the international seed trade, and from that angle, delegates saw a high level line up of speakers from the international arena on the recent developments: the Commission on Phytosanitary Measures, the Nagoya Protocol, the OECD, the International Treaty on Plant Genetic Resources for Food and Agriculture, the International Seed Testing Association, the Global Crop Diversity Trust and the International Plant Protection Convention. All these organizations have a potential impact on the seed industry, and ISF had contributed to shaping them.

Intellectual property and its enforcement were center stage during the Forage and Turf Section meeting. The participants got interesting updates from UPOV and Breeders Trust. A panel discussion led to animated discussions in the meeting of the Field Crops Section. The panellists discussed the outcome of the ISF publication "Collection Systems for Royalties in Wheat – An International Study". The importance of the Incoterms® was underlined in the meeting of the Trade and Arbitration Rules Committee, and the Seed Applied Technologies Committee dedicated ample time for a presentation on the Compass report, outlining the socio-economic value of neonicotinoids seed treatment.

The Vegetable and Ornamental Section saw a change in guard from long standing chairman Mr. Anton van Doornmalen to Mr. Vicente Navarro, and heard interesting presentations on how to do business in China and the SolCAP project. The Dutch ambassador to Greece honored the meeting with his participation. ISF's work on an International Standard for Phytosanitary Measures, specifically for seeds, was an important topic during the meeting of the Phytosanitary Committee.

During the congress, ISF adopted two position papers: the 'ISF View on Low Level Presence in Seed' and the 'ISF Viewpoint on Indirect Seed Health Tests'. Mr. Jean-Christophe Gouache of Limagrain, France, was elected as the new Second Vice-President of ISF. As is tradition, the Trading Floor was buzzing with activity, underlining the importance of the ISF World Seed Congress for the international trade. The beautiful venues of the Welcome Party and Gala Dinner gave every one the opportunity to have fun with friends and colleagues. During the closing Gala Dinner, the Greek Minister of Agriculture, Mr. Mr. Athanasios Tsaftaris addressed the audience on the importance of high quality seed and the investment possibilities in Greece. The Congress showed that the Greek seed industry and farmers have experience in the multiplication of seed and can secure high-quality production combined with a high yield. Greece, due to its placement on the map provides an excellent hub for managing business in South Europe.

The next ISF World Seed Congress will take place in Beijing, China in May 2014.

GSSA Spekboom Planting Festival at Modimolle/ Waterberg District

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The Grassland Society of Southern Africa's 48th Congress Organising Committee (GSSA C48 OC) held a spekboom (*Portulacaria afra*) planting festival at several schools around the Modimolle Municipal district on the 20 March 2012 as a build-up to its coming congress which will be held at Weesgerus in Modimolle (15th to 19 July 2013). The tree planting festival was a follow-up to the tree planting initiative that was conducted by the GSSA's 47th Congress Organising Committees in 2012, in efforts to educate the public about reducing the carbon footprint through planting trees. The spekboom was particularly selected for the Modimolle tree planting festival because of its drought-tolerant and fire-resistant characteristics as the festival was also organised in support of the National Water Week (18th to 24th March).

The Development Bank of Southern Africa (DBSA) donated 50 spekboom trees, with 5 trees given to 10 selected schools in the Modimolle/Waterberg District. However, the tree planting demonstrations which were officiated by representatives from the Department of Agriculture, Forestry and Fisheries, Limpopo Department of Agriculture (Bela-Bela and Polokwane Offices), Limpopo Department of Economic Development (Modimolle Office), were only conducted at the following five schools:

1. Dagbreek Primary School
2. Lekkerbreek Primary School
3. Hector Peterson High School
4. Phahameng High School
5. Solomon Mahlangu High School

Mr. Lombard Moloto, an official from Limpopo Department of Agriculture and a member of Modimolle Schools Agriculture Development Committee (MSADC) welcomed everyone at selected planting spots were learners were assembled at each school. Mr. Moloto also thanked the GSSA for this worthy initiative as it supports the Modimolle greening concept that is promoted by MSADC at schools to celebrate the various environmental days such as National Water week and Arbor day.

MSADC is a local committee facilitating agricultural and environment education at schools in Modimolle. The planting demonstrations commenced by following a structured programme that comprised of brief overview about the objectives of spekboom planting festival (including the GSSA and DBSA involvement on this initiative), brief information

about the spekboom tree (i.e. characteristics, planting methods, potential uses, and management requirements) and the actual spekboom planting demonstration.

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At the end of the planting demonstrations, the representatives of the different schools expressed their appreciation to the spekboom festival organisers for selecting their schools and also indicated that they hope this initiative could be extended to other schools in order to promote the planting of spekboom for reducing the carbon footprint.

The GSSA C48 OC requested Mr. Moloto to give the remaining trees to the other selected 5 schools in Modimolle (i.e Modimolle Primary School, Maokeng Primary School, Eenheid Primary School, Laeskool Nyl and Ulando High School).
The spekboom festival was an astonishing success and GSSA C48 OC would like to thank the DBSA, Modimolle schools and everybody who participated at the spekboom tree festival.

The Surprising Role of CO_2 in Changes on the African Savanna

Adam Welz

Recent studies show that many of the world's savannas, including famed southern African landscapes, are experiencing significant change as rising levels of carbon dioxide in the atmosphere favor the growth of trees over grasslands. Africa's savanna ecosystems — which include the thorn tree-studded plains of the Serengeti, the open woodlands of the Kruger National Park, and the dry, red sand savannas of the Kalahari — occupy about 70% of the continent south of the Sahara Desert. And evidence is mounting that these iconic and biodiverse landscapes are changing as rising levels of carbon dioxide in the atmosphere fuel the growth of trees at the expense of grasses, leading to an increasingly wooded landscape.

A 2012 survey of experimental plots in South African savannas — where fires, rainfall, and herbivore pressure have remained constant for decades — shows large increases in woody plant mass, which the authors primarily attribute to the so-called "CO_2 fertilization effect," the enhancement of plant growth caused by increasing atmospheric carbon dioxide. A modeling study published in the journal Nature last year describes a recent, rapid shift in extensive areas of African grassland and savanna to more densely vegetated, wooded states, a trend that is expected to accelerate in coming decades as atmospheric concentrations of CO_2 rise.

Already there are signs that open-country animals like the cheetah are suffering as savanna becomes more wooded. This trend is not confined to Africa. An Australian study released last month, which relied in part on satellite data, concludes that foliage cover in warm, arid areas worldwide has increased by about 11% in the last three decades due to higher CO_2 levels. Randall Donohue and colleagues at the Australian national science agency, known as CSIRO, and the Australian National University said that the CO_2 fertilization effect "is now a significant land surface process" shaping ecosystems across large parts of the planet. Guy Midgley, a prominent South African climate researcher who has authored several papers on CO_2 fertilization, said that the increase in arid-zone greening described in the Australian paper is "phenomenal." The study, he said, was a valuable addition to a growing body of evidence that the rising concentration of atmospheric carbon dioxide is directly changing terrestrial ecosystems, independent of temperature increase.

Although some might view an increase in desert plant growth as positive, an expansion of woody vegetation in savannas and grasslands could have serious negative effects, Midgley cautioned.

It could threaten and wildlife populations and water supplies, as trees and shrubs use more water than grasses. It could even amplify global warming, since trees, being generally darker than grasses, can absorb more solar radiation. Savannas can be seen as the result of a battle for living space between grasses and trees that neither side has won, said Midgley, chief director of the Climate Change and Bioadaptation Division of the South African National Biodiversity Institute. Should grasses win the battle, treeless prairies would result. If trees were to win, savanna would become increasingly dense woodland. Many African savannas are found in areas that have sufficient rainfall to support dense forest, but fire and large herbivores, such as elephants, constantly knock back trees, giving grasses space to grow and maintaining a rough equilibrium between the two sides. The "bush encroachment" observed across large swathes of southern Africa in recent decades is an example of the balance between grasses and trees being upset, he says.

In recent decades, across large tracts of southern Africa, ranchers and wildlife managers have been noticing an increase in woody vegetation. Shrubs and trees have invaded grasslands, transforming them into savannas. Savannas have become more densely wooded, sometimes impenetrably so. Anecdotal evidence and time series photographs indicate that this trend accelerated in the 1980s, and by the end of that decade "bush encroachment" was a commonly used term for what was happening in rangelands and wildlife areas across the subcontinent.

Namibia, a generally arid, thinly populated country to the northwest of South Africa, has been particularly hard hit; about 26 million hectares (64 million acres) of the country has been invaded by undesirable woody plants, which smother grazing areas. Because trees use more rain than grasses, they also significantly reduce groundwater recharge and runoff into rivers. The loss of grasslands is one reason the country's beef production is now 50 to 70% below 1950s levels, according to some estimates. Bush encroachment costs Namibia's small economy as much as $170 million per year.

Changes in savannas are also affecting wildlife. Conservationists in Namibia, home to the world's largest remaining population of cheetahs, began finding starving cheetahs with severe eye injuries about twenty years ago. Not only are their plains-antelope prey being crowded out by trees, but cheetahs — which prefer to hunt in open areas where they can exploit their famous speed — are also being blinded by the thorns of woody plants that are taking over the landscape.

Ornithologists studying the Cape vulture, a threatened southern African scavenger, have found that it avoids foraging for animal carcasses over bush-encroached areas. Cape vultures are large, heavy birds that need a long, clear take-off run to launch themselves into the air. To avoid becoming meals for predators, it seems that vultures simply don't land where the bush seems too dense for them to take off again. The species, once numerous in Namibia, no longer breeds there.

In the 1980s and '90s, the predominant view was that poor land management, especially overgrazing, was the main cause of bush encroachment because trees easily colonize the patches of bare earth created when too many sheep and cattle destroy perennial grasses. Some experts, however, noted that well-managed farms often suffered bush encroachment, too.

Although overgrazing may contribute to bush encroachment, they felt that some greater environmental change was helping woody plants to dominate grasses. In 2000, Midgley joined with William Bond, a University of Cape Town ecologist, to publish a paper proposing a mechanism whereby increased atmospheric CO_2 could favor trees over grasses in their battle for territory in African savannas. In these savannas, grasses are more flammable and more fire-tolerant than trees — they carry fire through the landscape and regrow rapidly after fire, requiring less time (and less water, soil nutrients, and atmospheric carbon) to achieve maturity than trees.

To become established in the landscape, savanna trees have to reach a height of about four meters to avoid having their stems and crowns destroyed by grass-fueled fire. In other words, trees only become established if they're given a break from fire long enough to build sufficiently tall stems to grow well above the flame zone. (Many African savanna trees are not killed outright by fire, but re-sprout from the roots after having their above-ground parts destroyed.)

Past research showed that savanna trees usually take four or more years to reach fireproof height, but most African savannas burn every one to three years, so it's only when there's a been rare, longer-than-normal break between fires that trees can mature. More CO_2 in the air means that trees can theoretically build their carbon-intensive stems and roots longer, thicker, and faster. Bond and Midgley hypothesized that because of this, trees could be growing and re-sprouting faster after fire than a few decades ago when the atmospheric CO_2 level was lower, thus increasing their chances of reaching fireproof height. Then, by out-competing grasses for water, nutrients, and light, trees could dominate the landscape.

More recently, to test if savanna trees do in fact grow faster in increased atmospheric concentrations of CO_2, Bond and Midgley's colleague, Barney Kgope, grew African savanna tree and grass seedlings in chambers that allowed him to vary the CO_2 levels in the air around the plants. The results, published in 2010, are striking. Some savanna trees grown in an atmosphere of 370 parts per million (ppm) of carbon dioxide (a little lower than today's level of 400 ppm) grew more than twice as fast as the same species grown in the pre-industrial atmosphere of 280 ppm of CO_2. Not only were the trees grown at 370 ppm taller than those grown in pre-industrial concentrations of CO_2, they had bigger thorns to protect them from herbivores and far more extensive root systems than their pre-industrial counterparts. They had, in Bond's terms, become "supertrees."

Researcher Donohue said that although the satellite images used in his new Australian study did not distinguish between green grasses and green woody plants, the trends he and his colleagues observed were consistent with a general increase in plant biomass across Africa due to CO2 fertilization. Although some news outlets have reported his study's results as demonstrating an "upside" to climate change because deserts are "greening," Donohue cautioned against this one-sided interpretation. "There will be winners and losers," he said, because increased vegetation in some arid areas may well increase local biodiversity, but may also harm species adapted to less-vegetated habitats. Guy Midgley has a more pessimistic view of atmospheric CO_2's apparently increasing influence. "We [South Africans] like our non-forest ecosystems," he said, noting that aside from the impacts that an increase in woody plants will have on grassland wildlife and livestock ranching, the country's grasslands form watersheds that feed rivers vital to the economy.

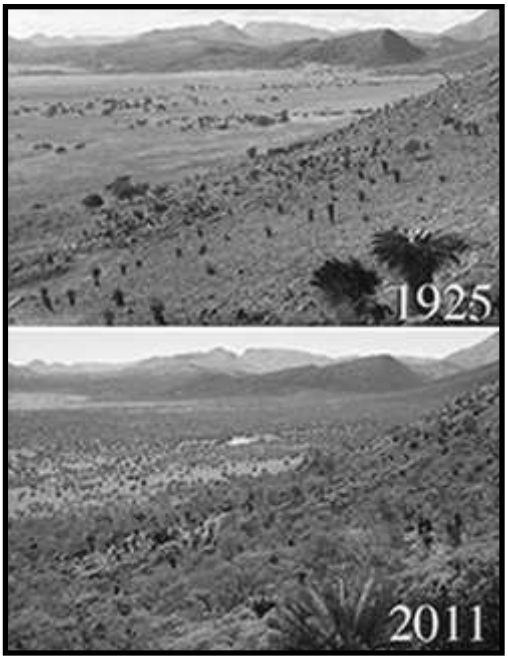
Studies show that water yields of South African grassland catchment areas drop significantly when invaded by alien trees, one reason that the government spends millions of dollars a year to remove them. South African ecologists are trying to figure out how best to stop trees from taking over savannas, perhaps with "fire storms" — controlled fires set on hot, dry days to maximize the heat they generate — or careful tree-thinning. But super-hot fires might have their own negative effects on ecosystems, and manual thinning could be too expensive.

Midgley said that by reaching today's level of 400 ppm of atmospheric carbon dioxide, "we've turned the evolutionary clock back 5 million years in under a century. It's a massive change in how our ecosystems work." He noted that atmospheric CO_2 could hit 600 ppm by 2100, a level last seen during the Eocene epoch of 34 to 55 million years ago, when forests covered nearly all of the planet and long before modern grasses and the large savanna mammals that we know today evolved.

"We're in a brave new world from a plant's perspective," said William Bond. "It's a little frightening. Our plains animals have their backs against the wall." The new invading trees won't do anything meaningful to combat climate change, he said, because they're a negligibly small carbon sink in global terms.

"We've got to stop the problem at source," he said. "We've got to stop burning fossil fuels and sending carbon into the air."

"Wangari Maathai was wrong," he chuckled playfully, referring to the Kenyan environmentalist and Nobel Peace Prize winner who advocated a tree-planting campaign across the continent. "Trees aren't always a good thing."



Changes in South African savanna, from 1925 to 2011.