Chapter 6


The significance of the mighty words of Humboldt that ‘by felling trees, which are adapted to the slopes and summits of mountains, men in every climate prepare for future ages at once two calamities: want of wood [sic] and scarcity of water seem no longer to be realised or heeded.’

—J. D. M. Keet, then Chief of the Division of Forestry in the Department of Agriculture, Union of South Africa, in his presentation to the fourth British Empire Forestry Conference.

Prelude to the fourth British Empire Forestry Conference, 1931–1935

The first British Empire Forestry Conference was held in London in 1920 in response to the British government’s establishment of a Forestry Commission after World War I. British Empire Forestry Conferences held in 1920, 1923 (Canada), and 1928 (Australia) brought together foresters and imperial officials to share information, encourage inter-colonial trade, develop important statistics and coordinate central management problems. Each conference had a significant local context and outcome. The Australian 1928 meeting, for instance,

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was instrumental in saving the Australian Forestry School in Canberra. So too would the fourth British Empire Forestry Conference have a lasting influence on South African forest history.

South Africa was to have hosted the fourth British Empire Forestry Conference in 1932. The conference was delayed by three years because of the Depression and South Africa’s decision to postpone the meeting until 1935 because of financial problems. The three-year delay may have fundamentally changed the nature of the conference. In 1934, the government placed the control of the Forestry Department (which became the Forestry Division) under the Agricultural Secretary, creating a joint Agriculture and Forestry Department, with Colonel Denys Reitz as Minister of Agriculture and Forestry. Reitz strongly sympathised with farmers who worried about the negative effects of tree planting in catchments, while also being sympathetic to foresters in his role as President of the South African Forestry Association from 1935 to 1939.

By 1935, plantation forests in South Africa extended to about 400,000 hectares, with around 90,000 planted for sawlog production. The Union government foresaw around 400,000 hectares of new sawlog plantations to substitute for sawtimber imports. Foresters, increasingly confident in their ability to profitably grow exotic trees because of new scientific innovations, saw a bright future for plantation forestry. This enthusiasm was tempered by shifting political winds and a growing scientific and agricultural critique of exotic timber plantations. Afforestation had accelerated by 1935 and would see an increase in area by 1 million hectares over the following 60 years. The intense contest over water resources, and indeed the protection of the country’s flora and fauna, may easily have headed off the trajectory.

In the 1930s, in South Africa and elsewhere, professionals and scientists in the fields of forestry and hydrology had no scientific evidence available to them of the relationships between forests, climate and hydrology adequate to the questions that they faced. Instead, they had a set of disparate observations, mainly from Europe, sundry strands of thought, usually tendentious, many myths from historically influential figures, and ancient and recent anecdotes, all loosely and variously woven together to create a polemised story about forests, water and floods that could suit the teller and the audience. Such experimental work that had been done mostly had political, rather than scientific, purpose.

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3 Bennett, ‘An Imperial, National, and State Debate’.
4 See PSC 4/6, SDK 37, NASA-P.
The orthodox view traceable to books by Alexander von Humboldt and Jean-Baptiste Boussingault in the early 1800s following their enquiry into the shrinking of Lake Valencia in Venezuela, and the apparent desiccation of the western aspect of Peru, was the notion of ‘climatic forestry’, with several standard rubrics: deforestation dries up streams, forests ‘economize and regulate their flow’, deforestation causes the diminution of rainfall, and so on. This paradigm was in turn set within the conviction of a nature in steady-state equilibrium, and the ‘pristine myth’—where nature is found to be in disequilibrium, this owes to human action; ideas which continue today to ‘haunt the sciences of climatology, ecology, and conservation’. And in a large degree through the force of the American George Perkins Marsh’s authorship, these Humboldtian ideas underlie much of modern environmentalism, as they did in the 1930s.

Although in South Africa John Croumbie Brown had written extensively on the topic of climatic forestry, in professional forestry circles it was Henry Fourcade who first paid careful attention to the authoritative reports on this question, and detailed his summary in his 1889 Report on the Natal Forests. In a chapter titled ‘On the Utility of the Forests’, Fourcade deals with forests and rainfall, forests in relation to climate, erosion, catchment degradation following deforestation, and the benefits of forests in flood control. He cites observations from the 1860s and later in France, Germany, Italy and Russia, as well as his own acute observations on local weather and climate. His authorities include Alexandre Surell, George Perkins Marsh, Ernst Ebermayer, Robert Hartig, John Tyndall, and D. E. Hutchins on rainfall fluctuations. On rainfall, he concludes that ‘forests do not materially, [but] they unquestionably regulate it, promote the frequency of showers, control the flow of water, which, on the whole, is a preferable effect’, and emphasises the reports from Europe of the decline in river flow attributed to deforestation. Fourcade describes the rainfall, topography and erosion in Natal in detail, drawing the analogy with the south of France, and concludes ‘[b]esides being cheaper, it is also better to preserve natural forests than to destroy them to substitute plantations which take centuries to acquire the deep layer of humus and the surface growth which give such a peculiar climatic value to the natural forest’, citing B. E. Fernow in the United States on the value of forests in the ‘rational management of the water capital’.

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8 Cushman, ‘Humboldtian Science, Creole Meteorology, and the Discovery of Human-Caused Climate Change in South America’, 41, 44.

9 See Beinart, The Rise of Conservation in South Africa.
When characterising the ideal humus and soil beneath the forest, Fourcade echoed Marsh’s vision of the ideal forest floor condition—the characteristic of the ‘true forest’. Marsh summarised his views on the general consequences of the destruction of the forest:

> With the disappearance of the forest, all is changed … the melting snows and vernal rains, no longer absorbed by a loose and bibulous vegetable mould, rush over the frozen surface, and pour down the valleys seaward, instead of filling a retentive bed of absorbent earth, and storing up a supply of moisture to feed perennial springs … The face of the earth is no longer a sponge, but a dust heap, and the floods which the waters of the sky pour over it hurry swiftly among its slopes, carrying in suspension vast quantities of earthy particles … The rivulets, wanting their former regularity of supply and deprived of the protecting shade of the woods, are heated, evaporated, and thus reduced in their summer currents, but swollen to raging torrents in autumn and in spring.10

Ideas of what a forest is circled around these characterisations of climatic forestry, and much of the debate about ‘forest influences’ at the forthcoming conference reduced the question to whether plantations were true forests, and whether the state of the forest floor and its humus was similar with a natural forest. Clearly forewarned, Jan Smuts took care in his speech to emphasise the fact that South Africa was ‘not a forest country’, that unlike ‘the other parts of the world’ the delegates came from—‘the climax there is forest’. In South Africa, he noted that ‘the climax is something quite different’. Smuts believed that ‘[s]oil development is a complex phenomenon in South Africa, where the rate of decomposition of organic matter is very rapid, and where formation of the ideal humus rarely takes place’.11

George Perkins Marsh helped politicise forestry in the United States, inspiring a series of developments leading to new forest law in the US, and the acquisition and reservation there of millions of hectares as national forest under the banner of protecting the ‘water capital’.12 Bernhard Fernow, the first professionally trained forester to head the then Division of Forestry in the US Agriculture Department, from 1886 to 1898,13 took up the polemics of forest management in favour of the water capital. In 1893, he published a book called *Forest Influences*, in which he reviewed the ideas of the time on the effects of forests

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13 A. D. Rodgers, *Bernhard Eduard Fernow: A Story of North American Forestry* (Princeton: Princeton University Press, 1954); Fernow would later employ the idea of climatic forestry to motivate the planting of a vast shelterbelt of trees to prevent the spread of the dustbowl in the American Mid-west, 100 miles wide and 1,150 miles long.
on climate and rainfall, effects which he acknowledged were difficult to prove.\(^\text{14}\) Reasoning from first principles, as well as empirical evidence from Europe and India, he argued: ‘without forest management no rational water management is possible’.\(^\text{15}\) Gifford Pinchot, the first Chief of the US Forest Service (1905–1911), knew France well since he had studied at the forestry school of Nancy and was familiar with the early forest hydrological work there.\(^\text{16}\) Writing in 1905, he emphasised: ‘It is unfortunate that so much of the writing and talking upon this branch of forestry has had little definite fact or trustworthy observation behind it. The friends and the enemies of the forest have both said more than they could prove’.\(^\text{17}\) (And, by 1912, Zon also was warning that the US Forest Service had overstated the significance of forests to flood control.)\(^\text{18}\)

These ideas characterised what might be termed the ‘propaganda period’ in forestry, a period when forestry advocates used anecdotal evidence and professional authority to justify the setting aside of vast swaths of forest for climatic and hydrological purposes. Some of the most vivid illustrations come from the USA, where foresters such as Gifford Pinchot argued strenuously for the expansion of US Forest Service powers to manage catchments. The conflict over the Hetch Hetchy Valley, where it was proposed to build a dam to provide San Francisco with water, was one of a series of conflicts regarding the role of forestry and dams in water hydrology management.\(^\text{19}\)

At their height of power in the 1910s, US Forest Service officials sought to have Congress authorise the federal purchase of large areas in the east to restore forests, and argued for this on the basis of flood-mitigation claims and the benefits to navigable waters, seeking power and fiscal provision for this purpose under the Weeks Law of 1 March 1911. This law required that forest land be acquired by the Forest Service only in those cases where ‘the purchased lands would be permanently maintained as federal forest reserves as a way to protect navigable waterways’.\(^\text{20}\) To meet the requirements of Congress for evidence of forest benefits to navigable waterways, investigators executed a dubious experiment in


\(^{15}\) Ibid., 12.


\(^{19}\) Conflicts raged throughout the US as foresters tried to have vast catchments set aside for hydrological purposes. One of the most well-known examples—then and now—was the fight over the Hetch Hetchy Valley. See R. W. Righter, *The Battle over Hetch Hetchy: America’s Most Controversial Dam and the Birth of Modern Environmentalism* (New York: Oxford University Press, 2005).

the White Mountains of New Hampshire. The US Geological Survey conducted a brief study of 11 watersheds during the spring and summer of 1911–1912, compared two catchments—one that had been cut-over and another that had not—during a spateflow, and without any prior data of the previous streamflow of the two catchments, concluded that the forested area had less runoff, and hence less damaging floods, than the deforested: ‘a given amount of precipitation on a deforested or burned area causes a sharper flood wave and a greater flood flow than does the same precipitation on a tree-covered area; further, that the streams draining the former are not flow-sustaining during long rainless periods as well as those draining the latter’.21 This evidence was submitted to Congress, which used it to justify the application of the Weeks Law, an action that led to the subsequent purchase of 6 million acres of privately owned land in the American east.22

Foresters in South Africa who thought about forests and water were connected to the ideas of Humboldt, George Perkins Marsh and Bernhard Fernow through the work of Henry Fourcade as well as through their education, and used the idea of climatic forestry to motivate the public interest in plantation forests. Their colleagues in the irrigation sector, such as F. E. Kanthack and C. D. H. Braine, allied with them in this argument.23 Forestry was an environmentalists’ domain in the northern hemisphere, and strongly politicised. But in South Africa, sceptical questions about climatic forestry had led as early as 1910 to the early catchment experiment at Jessievale, while J. D. M. Keet, as much as he promoted plantation forestry, took the sceptics seriously by his careful enquiries into cases of ostensible stream declines caused by afforestation. The fourth British Empire Forestry Conference, populated as it was by articulate proponents of climatic forestry,24 would prove to be the forum where this orthodoxy would encounter full on the arguments of the sceptics. It was in a large degree owing to the intellectual leadership of Jan Smuts and Deneys Reitz that the dissent at this conference yielded a positive, scientific synthesis of ideas, rather than a one-sided loss.

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24 Delegates included R. S. Troup, then of the Imperial Forestry Institute at Oxford. Troup had been a student of Wilhelm Schlich at Cooper’s Hill, who in turn had been mentor of Gifford Pinchot. Sir Roy Robinson of Australia had also passed through Schlich’s hands. C. G. Trevor quoted the same sources on desiccation in the ancient world as did George Perkins Marsh.
Public and scientific criticism of afforestation reached a crescendo prior to the conference. That year Parliament had confirmed the Forestry Division in its role as manager of the nation’s catchments, a controversial decision that shaped hydrological research in South Africa for the rest of the twentieth century. The Professor of Botany at Witwatersrand University, John Phillips, and the director of the South African National Botanical Survey, Illtyd Pole-Evans, tried to use their connections with Jan Smuts and other Afrikaner agricultural officials to prevent afforestation at various sites on the basis of their negative impact on streamflow and on the natural flora. The Minister for Agriculture and Forestry, Colonel Deneys Reitz, confronted by questions in Parliament, deferred making a decision based on these concerns until he had received the advice of the Conference.

Foresters and critics of forestry staked out their positions on afforestation months before the conference began. In 1931, Phillips had returned to South Africa to take up the post of Professor of Botany at Witwatersrand University in Johannesburg, Smuts having lobbied on his behalf for the appointment. Phillips became actively involved in forestry politics. Phillips and Pole-Evans led a behind-the-scenes lobbying against the Forestry Division’s policies, taking forward Pole-Evans’s campaign. Before the meeting, Phillips and Pole-Evans sought to convince Smuts and Reitz about the negative impacts of exotic plantations. Pole-Evans used his position as the Chief of the Division of Plant Industry in the department to appeal to Reitz to shut down exotic afforestation near streams and rivers. In a memorandum dated 4 March 1935, he declared that afforestation ‘will inevitably destroy … the streams’ and the flora. Reitz did halt the afforestation in one instance, though the area concerned was small. At the same time, Pole-Evans wrote to Smuts about his letter, telling him that foresters made ‘a great mistake in planting these exotic trees’ and that the effects on water ‘were becoming apparent all over the country’. Pole-Evans also began an exchange of memoranda across the desks of their joint head of department, P. R. Viljoen, Reitz as Minister, and Keet, the Chief of the Division of Forest Management in South Africa, regarding his concerns about the desiccating effects of exotic trees planted near water sources.

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26  Also see Phillips to Smuts, 3 March 1935, Smuts Collection, 238/53, NASA-P; Phillips to Smuts, 4 August 1935, Smuts Collection, 238/53, NASA-P.
27  Anker, *Imperial Ecology*, 144.
29  Ibid.
30  Pole-Evans to Smuts, 8 March 1935, Smuts Collection, 238/53, NASA-P.
Pole-Evans was not able to attend the conference, and he proposed Phillips as his substitute. Phillips also corresponded privately with Smuts during the conference. Keet had adamantly opposed this substitution, because Phillips was a strong critic of exotic afforestation and an ally of Smuts. Phillips was aware of the heated debate between Keet and Pole-Evans. He wanted to represent Smuts and Pole-Evans but sought a compromise by asking Smuts to help solve ‘water-supply controversy that has been raging between Dr Pole-Evans and Keet’.31 Keet was not convinced by Pole-Evans’s arguments: his own investigations of several cases of complaint in the field persuaded him that the current claims of afforestation effects were groundless, because streamflow decline could be ascribed to the current droughts, or because apparent shortage was owing to overestimates by would-be irrigators of the streamflow available for their new farms, or because effects could not be attributed to the plantations, their being too small in extent, or too young, to have decreased streamflow.

Despite the public concerns and behind-the-scenes moves on forestry and water, the approach by South African delegates and participants to the conference was reasoned and measured. Jan Smuts had prepared a speech emphasising the economic necessity of plantation forestry in South Africa and hence the necessity of a comprehensive research program, while Deneys Reitz provided a cool appraisal of farmers’ concerns and his own observations about forests and water, while respecting, and challenging, the opinions of his forestry officials. Two months before the meeting, Keet distributed an official memorandum to all his professional staff and all concerned parties, including Phillips, briefing them on ‘the whole question’ of exotic trees and their impact, which he identified as ‘a major issue for discussion’ at the conference.32 This memorandum included excerpts from official correspondence exchanged between Keet and Pole-Evans during 1935, as well as passages from parliamentary debates, extracts from letters from conservation bodies and material from Smuts’s speeches. Keet’s memo highlighted all the points that would arise in the conference on these issues.

The South African organisers prepared not only for the regular agenda and program of the conference, but also for special deliberations on the particular question of the ‘water-supply controversy’.

The conference

The conference brought together foresters from around the British Empire. At that time, the fourth British Empire Forestry Conference was the major international forum for the discussion of forest science, policy, and practice. Its delegates ‘managed environmentally every major forest type in the world … Fifty separate forest services protected not only trees but also soil, water, and—so foresters believed—the climate of entire continents and regions’. (The other forum, now IUFRO, the International Union of Forest Research Organizations, at that time represented only a number of forest research stations in Europe.) The conference assembled in South Africa the leading foresters in the world at that time, outside Europe and the USA.

In September 1935, delegates to the fourth British Empire Forestry Conference travelled by train and steamship to Durban, South Africa, for the opening, with Deneys Reitz as host. They met in Durban, Pretoria and Cape Town and toured as a group throughout the forestry regions of the Transvaal, Natal, and Cape provinces. They enjoyed excursions to indigenous and plantation forest stations, as well as a tour of the Kruger National Park. The conference began on 2 September 1935 in Durban. The opening speeches by Colonel Deneys Reitz and the Secretary for the department, Dr P. R. Viljoen, laid the foundations for a searching debate. Reitz, elected President of the conference, challenged delegates to address questions about afforestation effects on water supplies and climate. He said that there was a growing belief among farmers that exotic trees were desiccating South Africa:

> For more than a century we in South Africa have been planting trees, chiefly pines and eucalypts, under the impression that such plantations were valuable for the conservation of water. It has now been put to me that in this way we are decreasing the humidity and drying the soil … I think we may possibly be in the position that while we are now spending millions on planting trees, we may ultimately have to spend more millions in uprooting them.

Reitz related that ‘irate farmers’ had accosted him recently to complain about the dangerous desiccating effects of exotic trees. He noted that Dr Viljoen had also raised the troubling issue of exotics and their influence on water and soil erosion. Reitz requested the conference, and delegates agreed to form

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34 See Department of Agriculture and Forestry, *Fourth British Empire Forestry Conference, General Program and Notes on Tours to Be Undertaken* (Pretoria: Government Printer, 1935).
36 Ibid.
37 Ibid.
a committee to investigate the issue. This became the Committee on Forests in Relation to Climate, Water Conservation, and Erosion (the Committee on Forest Influences). Professional foresters led the committee, although other scientists and attendees offered comments, which were published in the proceedings. The committee discussed the relationship of forests and climate in its broadest sense. In particular, South African participants debated the effect of forests on stream runoff; ‘the drying up of streams’; choice of different forest species and management regimes, and the effects on catchment hydrology, including water physiology, soil conservation and effects of plantations on soil processes compared with natural vegetation; ‘the question of veld burning’ and veldfire management; the need for long-term catchment experiments; and aesthetic and economic trade-offs with afforestation.

Conference attendees spent most of their time in Pretoria, the administrative capital of South Africa. General Jan Smuts, the present and future prime minister of the Union of South Africa, welcomed foresters to Pretoria on 8 September. He explained the necessity of afforestation with exotic species of trees, being ‘pessimistic about the prospects of extending the country’s indigenous forests’, but criticised the ecological and aesthetic impact of exotics. Smuts hated exotic pines being planted on his beloved Table Mountain, although he had been a strong advocate of the Forestry Department throughout his former prime ministership (September 1919 – June 1924). Again, Smuts reminded the foresters at the conference about widespread popular criticisms of exotic trees:

There is no doubt that a popular feeling is arising in South Africa that afforestation is causing the drying up of springs and water sources. Although this has not been proved it can be said that a sufficient case has been made out for thorough research.

Jan Smuts urged delegates to ‘frankly admit that South Africa is not a forest country’, and that ‘we are … thrown for afforestation purposes to the planting of exotics’. But he then raised all the issues about the use of exotic species

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38 Union of South Africa, Forests in Relation to Climate, Water Conservation and Erosion Pretoria (Pretoria: Department of Agriculture and Forestry, Division of Forestry, 1935), preface.
40 Ibid., Smuts, 81.
41 Ibid., Viljoen, 6; Smuts, 81; Keet, 114–6.
42 Ibid., Smuts, 82.
43 Ibid., 82; Phillips, 127.
44 Ibid., Smuts, 82.
47 Anon, ‘Forestry Research Essential’.
6. 1935: The Fourth British Empire Forestry Conference in South Africa

of trees—the concern about alien invasive plants, the protection of flora, and the management of fire in vegetation—that pervaded the debates in the formal meetings, as well as during the extensive field tours that the delegates enjoyed. He challenged the assembled forest scientists on all fronts: ‘We know little about our own forests, and practically nothing about the strange forms which we have been importing into South Africa. Our forestry problem is therefore one of research, and endeavour to get at the facts’. He advocated forest policy research: ‘where the best national policy would dictate afforestation or the conservation of the natural vegetation’; ‘careful research into the water question’; ‘the soil question’, ‘comparative study of the water and soil building and conserving characters of natural forest, fijnbos, … and other vegetation, and of exotic plantations, a necessity’, ‘long range experiments upon watershed areas’, and ‘aesthetic and economic issues’.49 This speech contained all the ideas that later influenced the research agenda that emerged with the establishment of Jonkershoek.

The work of the Committee on Forest Influences

On Wednesday, 11 September, the Committee on Forest Influences met to debate the influence of exotic trees on climate, the conservation of water and soil erosion. The panellists comprised a wide variety of attendees, though it was chaired by C. G. Trevor from India and dominated by foresters who supported afforestation.

After hearing reasons in favour of afforestation from an Indian and Australian forester, Keet spoke.50 He strongly defended the use of exotic trees, especially against those whom he called ‘[f]orest alarmists … who regard grass and veld generally, as more efficient agents in conserving the water supplies of this country’.51 These forest alarmists—probably specifically with Phillips and Pole-Evans in mind—criticised exotic timber plantations for using more water than the native plants of South Africa, and viewed exotic trees, especially Acacia and Eucalyptus, as helping to cause the decline of streamflow and water tables in the country. To the forest alarmists:

It is our plantations, especially, that stand suspect. They are accused of being ecologically foreigners to our climate, and South African foresters are accused of confusing natural forest conditions with exotic forest conditions, and that generally we have ignored the ecological outlook.52

49 Ibid., 79–82. See also Powell, ‘Dominion over Palm and Pine: The British Empire Forestry Conferences 1920–47’.
51 Ibid., 25.
52 Ibid.
Keet challenged the argument that forestry as practised in South Africa was not ‘ecological’ by responding: ‘The forester lives with nature, studies nature, and follows nature’s law, and if that is not ecology, I fail to see what ecology can be’.53 Keet disagreed that exotics used more water, pointing out that they often acted as pioneers for native species of ‘moisture-loving’ trees, eventually leading to the creation of indigenous forests. He ended his speech by noting that ‘we are on perfectly right lines with our exotic plantations in South Africa’.54 The foresters in the audience applauded, ‘Hear, Hear’.55

The strongest critic at the committee was John Phillips, who was then at the height of his career and had the ear of Jan Smuts.56 Phillips challenged the views of foresters by pointing out the erosion and local desiccating impacts caused by exotic trees that he witnessed throughout South Africa. He argued that Eucalyptus and Acacia often encouraged greater erosion than caused by native grasses and used more water:

Those studies that we have carried out in this country most definitely show that the water requirements and the rate of water usage and transpiration are considerably greater in the gums, acacias, and the Blackwood [Acacia melanoxylon] ... as compared with those native shrubs and trees which have been investigated at the same time.57

Phillips challenged foresters to provide empirical data to support their conclusions, rather than relying—as did Phillips himself and other foresters in attendance—on anecdotal claims. He challenged foresters:

I ask you again to forget traditional concepts. Here we need long range research—we want to select certain catchment areas which will have a number of streams. We must investigate the regime and life-history, as it were, of these streams over a sufficient period. We must do this quantitatively, and must work most critically and with a sufficient number of these, and treat them in different ways.58

Going beyond the matter of water supplies, Phillips noted the negative ecological impacts of exotic trees. Phillips asserted that Keet’s example of exotics pioneering indigenous trees was wrong. Indigenous trees rarely grew in areas planted with exotic trees.59 He provided anecdotal evidence of gums and wattles killing off the growth or grasses nearby. Phillips implored attendees to look at the problem scientifically, through rigorous studies that examined the actual

53 Ibid.
54 Ibid., 25–6.
55 Ibid., 26.
water usage and transpiration of native flora compared with exotic plantations.\textsuperscript{60} He called for nothing less than an expansive (and expensive) research program into the hydrological and ecological impact of exotic trees. Phillips suggested the research would require no less than a 20- to 30-year program to ultimately resolve the debate about the influence of exotic trees on South Africa’s climate and water cycle.

South African foresters consistently rebutted the claims that the exotic plantations had caused the drying up of streams and increased erosion in South Africa, compared with indigenous vegetation types. They admitted that forests, along with certain types of vegetation, did use water resources. The question, as posited by J. D. M. Keet, during the fourth British Empire Forestry Conference, was rather what type of land use provided the maximum benefit for South Africa’s water supply: ‘It is not the maximum quantity of water, however, but the maximum beneficial yield of water that we are after. We cannot cater for the demands of those reservoir engineers, who realising that all plant growth, like all living matter, must use up water to live and grow, demand catchment areas paved with bare rock’.\textsuperscript{61} Foresters emphasised that forestry provided, in certain contexts, the best use of land and water at the same time that it offered climatic and ecological benefits.

In the committee’s final report, foresters exonerated South Africa’s forest policy. The report noted: ‘We cannot do otherwise than commend any and all efforts which are being made, for which can be made, to bring under forest cover a greater proportion of the land area of the Union’.\textsuperscript{62} It saw no evidence to indicate that exotic trees reduced soil moisture and streamflow: ‘we do not consider that the afforestation policy of the Government of the Union of South Africa has been detrimental to the general water supply of the country’.\textsuperscript{63} The report noted that ‘diminishing rainfall’ was the primary culprit.\textsuperscript{64} To allay the fears of the ‘farming community’, the report noted that the belief that exotic trees caused desiccation ‘is at variance with the generally accepted conclusions regarding the effects of forests on streamflow’. The report dismissed Phillips but recommended a program of research: ‘All things considered, we are not disposed to place much credence in the complaints instanced above … but we suggest that a comprehensive scientific investigation on the effects of tree-planting upon local water supplies would be of value’, ‘which would be of inestimable advantage to it and the world at large, and which might allay certain fears which

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\item \textsuperscript{60} Ibid., 34.
\item \textsuperscript{61} Fourth British Empire Forestry South Africa 1935 Proceedings, 115.
\item \textsuperscript{62} Union of South Africa, Forests in Relation to Climate, Water Conservation and Erosion, 9.
\item \textsuperscript{63} Ibid., 13.
\item \textsuperscript{64} Ibid., 12.
\end{itemize}
the public have expressed’. While it would take many years before results would emerge, ‘in order to allay public anxiety’, fast-growing exotics should not be planted ‘in the actual sources of streams and the eyes of springs; in such places the natural vegetation should be carefully protected’, affirming that ‘the Forest Department is already acting on these lines’.

Common purpose

Thus, in spite of disagreements, South African foresters were receptive to research. Keet agreed with Phillips on the need to pursue empirical research into forest hydrology. And in fact, three years prior to the meeting, the Forestry Department had acquired land in the Jonkershoek Valley near Stellenbosch to pursue a major hydrological experiment studying whether exotic timber plantations used more water than indigenous vegetation. South African foresters had also acknowledged the need to balance forest development with the protection of water catchments. That is why Keet had emphasised in 1935 that the department would afforest only one-fifth of the state forest–managed land, while protecting catchments and their indigenous vegetation on the other four-fifths. Thus instead of talking past each other, foresters and their critics found common ground on the need to afforest conservatively and to study the impact of exotic trees on water supplies. This agreement between foresters and ecologists formed the basis of a new research program that lasted for over 50 years.

The 1935 British Empire Forestry Conference should be understood as the event that helped to crystallise political support for a major research program that was already underway. Participation by leading politicians such as Jan Smuts and a broad array of scientists and agricultural officials ensured that foresters had widespread support to pursue what would be a long and expensive research program. The conference also helped to enshrine a basic underlying belief that would govern research and policies regarding forests and water from the mid-1930s until the early 1990s. Politicians and critics of forestry demanded policies that were evidence-based, practical, and would be constantly reviewed. Foresters in turn agreed that ‘[in] the reciprocal relationship between theory and experience the latter must hold sway, until at least the former has been proved in practice’.

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65 Ibid., 13, 16.
66 Ibid., 13.
68 Ibid., 155.
Early foundations of a consensus agenda

The debate about hydrological research at the 1935 conference must be understood as the culmination of a discussion that began at least as early as the Union in 1910, when the first hydrological research began, not as the origins of Jonkershoek.\(^70\) Informed opinions on the question of forests and water supply were not orthodox, and not all foresters agreed that afforestation would benefit water supply. Charles Legat, for example, did not believe that eucalypts, at least, favoured increased streamflow. Writing in 1920 in response to an enquiry from one of his officials, he states that ‘Eucalypts have frequently been planted near springs in this country and … little doubt that their effect is prejudicial’ [to water supply]. In support of his argument he cited a report by D. E. Hutchins, ‘A Discussion on Australian Forestry’, as well as the direct arguments of W. E. Abbott, who in a paper, ‘Forest Destruction in New South Wales’, read before the Royal Society of New South Wales in July 1880, claimed to ‘predict with absolute certainty that … the effect of destroying the natural eucalypt forests will be to cause a permanent increase of water in such water-courses and produce springs where there were none before’, Legat thus inferring the reverse with afforestation.\(^71\)

Soon after Union, questions about plantation forests and water prompted officials to attempt measurements of effects on streamflow. Notwithstanding the views of Kanthack and Braine, expressed just a few years before, the Union Irrigation Department initiated hydrological research at a newly planted state forest at Jessievale in the east of the Transvaal beginning in October 1910.\(^72\)

But by 1924, it was clear from the failure of gauging techniques and the loss of records that an investigation incidental to routine forest and hydrographic activities was not yielding reliable information.\(^73\) The Jessievale study subsequently grew to incorporate three gauged streams, and ran until 1963; but it yielded no scientific results,\(^74\) probably because scientists did not trust the experiment to the extent of investing in its analysis.

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\(^73\) J. D. Keet, Conservator of Forests Transvaal and Orange Free State Conservancy to Chief Conservator of Forests, 7 May 1924, R7649/711, SAFRI Archives, CSIR, Pretoria.

\(^74\) Email 14 June 2013 from Brian Jackson, Manager: River operations & Data Management, Inkomati Catchment Management Agency.
In parallel with this research effort, foresters had made strenuous efforts to anticipate and respond to concerns from downstream water users. At the fourth British Empire Forestry Conference, the then Administrator of the Transvaal, S. P. Bekker (speaking some years later, himself a farmer in the east of the Transvaal), laid out a succinct statement of the problem in his constituency:

we have a belt a couple of hundred miles long and 30 miles broad, which has an assured rainfall, and where the only perennial streams and rivers are to be found in the Transvaal Province … I know that farmers in that part of the Province are very much perturbed over the effects of planting these pines and gums on the sources of these streams and rivers which have to irrigate the fertile land at the bottom of these ranges.75

Bekker’s belt of country with assured rainfall is the escarpment of South Africa’s interior highland, cresting in this part of the country at about 2,000 m above sea level, and falling rapidly to the undulating lowlands of the Lowveld to the east, about 300 m above sea level. The cool climates of the higher elevations, with rainfall of around 1,500 mm per year, are ideal for forestry; in the foothills, the warmer climates suit tropical fruit production, but irrigation is needed under the lower rainfall regime there. The ancient granites that underlie the foothills along the lower half of this gradient yield deeply weathered, highly erodible soils. The upper half of this landscape, from 1910 onward, became the focal region for investment by both government and mining capital in sawlog and mining-timber forests, of pine and eucalyptus; eventually, this investment created what for a time were the largest planted forests in the world. Below this belt, World War I veterans received the opportunity to acquire land for farming.76 In this context, the exchange between the White River Valley Farmers’ Association, irrigators of the fertile land below the escarpment, and forestry officials illustrates the many lengthy engagements arising from concerns about forests and water supply.77

Finding the land on these slopes often to be degraded through mining, sheep grazing, cultivation and veld burning, foresters saw afforestation as the way to repair this, and held still to the view that afforestation with pines of the belt

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76 This was part of the government’s hesitant program to promote rural development through immigrant anglicisation. See Fedorowich, ‘Anglicisation and the Politicisation of British Immigration to South Africa, 1899–1929’.
77 White River Valley Farmers’ Association to Private Secretary, Minister of Agriculture, 18 May 1934, Wicht Papers, SAFRI Archives, CSIR, Pretoria; Captain C. V. Palmer to J. D. Keet 18 June 1934, Wicht Papers, SAFRI Archives, CSIR, Pretoria; White River Estates Irrigation Board to Director of Forestry, 24 June 1936, Wicht Papers, SAFRI Archives, CSIR, Pretoria; Memo C. 203 of 24 June 1934, J. D. Keet ‘Complaints re streams drying up on Bultfontein’, Wicht Papers, SAFRI Archives, CSIR, Pretoria; A. J. O’Connor for Director of Forestry to White River Estates Irrigation Board, 11 August 1936, Wicht Papers, SAFRI Archives, CSIR, Pretoria.
along the escarpment would enhance water resources.\textsuperscript{78} Still, aware of potential concerns regarding afforestation effects on water supplies to downstream irrigators, foresters assessed streamflow in the catchment of the White River in 1922, prior to planting from 1927 onward; they estimated that the flows were in any case too low to support irrigation without the construction of storage dams, a view confirmed by the history of the development of the White River Irrigation Farmers Association. They thought that the land was so degraded by erosion and soil crusting that it did not function effectively as water catchment; afforestation would improve the condition of the land. The severe drought that set in around the time of afforestation onward confounded attempts to respond to these concerns—in this location, annual rainfall was about 25 per cent above ‘normal’ immediately prior to afforestation, and 25 per cent less afterward. Drought was accompanied by rising complaints from farmers. Foresters wrestled with their preconceived ideas and conflicting views about forests and climate, their sketchy knowledge of hydrology, the distress of the farming community, and the scepticism of Colonel Deneys Reitz, Minister of Agriculture and Forestry.

Forestry officials, though confident of the wider economic and environmental benefits of exotic tree planting, having learnt from their detailed local case studies, began to take action in the early 1930s to forestall any localised problems arising from the planting of trees in catchment areas. In 1932, the Department of Forestry adopted the policy of keeping a 20-metre buffer zone between a stream and a plantation to mitigate effects of their plantations on streamflow.\textsuperscript{79} That same year they decided to start a major hydrological research site in the Jonkershoek Valley and began to acquire the necessary land for it.\textsuperscript{80} And in November 1935, J. D. M. Keet issued a circular instruction to all forest officers reflecting the recommendation of the conference committee on ‘Effects of Afforestation on Climate, Water Supplies and Erosion’, containing instructions confirming the moratorium on afforestation along streams and near springs, but also instructing officers to take measures in afforestation plans to protect ‘species of special botanical interest or vistas of peculiar beauty’.\textsuperscript{81}

\begin{itemize}
  \item \textsuperscript{78} J. D. Keet, R9110 of 21 October 1933 to Chief, Forestry Research, ‘Invloed van bos op stand van water’, Wicht Papers, SAFRI Archives, CSIR, Pretoria.
  \item \textsuperscript{79} Report of the Interdepartmental Committee of Investigation into Afforestation and Water Supplies in South Africa, 12.
  \item \textsuperscript{80} See J. J. Kotze’s comments in Union of South Africa, Fourth British Empire Forestry Conference Proceedings, South Africa, 293.
  \item \textsuperscript{81} J. D. M. Keet, ‘Water Conservation and Aesthetics in Relation to Afforestation and the Propagation and Preservation of Indigenous Trees and Flora’, Department of Agriculture and Forestry, 22 November 1935, Wicht Papers, SAFRI Archives, CSIR, Pretoria.
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Conclusion

The fourth British Empire Forestry Conference marked an important shift in the history of environmental sciences in twentieth-century South Africa. At the time of the conference, forestry was still the dominant conservation discipline—ecology having only recently been developed in South Africa by foreign-born and foreign-educated scholars.82 Yet the fourth British Empire Forestry Conference was a turning point in the power of professional foresters. They had to work within an increasingly complex scientific and policy arena that was often hostile to forest policies. The establishment of the Jonkershoek Forest Research Station was a response to forestry critics that also gave foresters the opportunity to pursue empirical research that could guide forest policy. The decision showed the serious intent on the part of the South African community of foresters to pay meaningful attention to a question that not only was the source of public controversy, but which also vexed their own minds.
