Imperial Ecology

Environmental Order in the British Empire, 1895–1945

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seems to provide better philosophical explanations for why humans have—irrespective of biotic background and ecological belonging—equal and unique capabilities to create history, alter the environment, and participate in the public sphere, although a defense of this position would require another volume, and has indeed been published elsewhere.[6] All the reader needs to know is that population ecologists and deep ecologists as well as environmental historians and philosophers have long challenged the idea that humans have a unique moral and political status among species in the web of nature. This criticism—which ranges from subtle philosophy to vulgar generalization—attempts to break down boundaries between what is human and what is natural. It is in the spirit of this ongoing debate that this book explores the oppressive potential of accepting the ecologists' advice to integrate the human condition and society into nature's household.

Finally, this is not a comprehensive history of ecology. Of all its rich material this book only includes that which may explain the evolution of botany into human ecology. On the way, I hope to prove Charles Elton incorrect when he wrote that "[w]e have to face the fact that while ecological work is fascinating to do, it is unbearably dull to read about," a remark once underlined in bright red by a Harvard University student.[7]

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From Social Psychology to Imperial Ecology

The ecologist and botanist Arthur George Tansley once amazed his friends by saying that Sigmund Freud would prove to have the most lasting influence upon the world since Jesus Christ.[1] This appears to be a remarkable comment from the president of the British Ecological Society, longtime editor of the *Journal of Ecology* and the *New Phytologist* as well as author of key monographs, and founder of the ecosystem theory. Yet he also wrote books and articles and lectured on sex-psychology, which raises the question of what (if anything) psychology had to do with ecology and how he found a link between them. In order to provide an account of this apparent schism in his thinking I will argue that three elements of his research intertwine: He was a socially concerned scientist committed to the moderate political left; he was a strong admirer of Sigmund Freud, who used his psychology to develop ecology; and he thought the chief aim and method of ecological research was colonial exploration and exploitation.

Tansley's life and work up to 1927, when he was offered a professorship in botany at Oxford University, will be the subject of this chapter. The first section uses Tansley's early life as a guide through the British ecological debates at the turn of the century, in which research along plant geographic and genetic lines at University College, London, confronted morphology among Scottish ecologists. The debate was devastating to Tansley, who turned to psychology and Freud for psychoanalysis and professional renewal, and then returned to London where he used his theories of the mind to develop his mechanistic view of nature and ideas about ecosystems. There was no job awaiting Tansley in London upon his return from analysis in Vienna; the final part of this chapter discusses his attempts to find patronage in various imperial and colonial groups. Using Freudian theories of the human mind and social psychology as a departure, he explored how the aims and methods of ecological research could enhance British imperialism, a project that finally generated the Oxford professorship in botany.

Despite their obvious importance in his work, Tansley's support of social-

ism, Freudian psychology, and imperial ecology has been poorly understood by both practitioners and historians of ecology. It is rare to find references to his psychological works at all, much less any discussion of their significance. The common interpretation of Tansley's political views is that they were conservative. One historian of ecology argues that Tansley's "political ideology of plant ecology" implied "a commitment to individuality," that his "bourgeois [Freudian] analysis . . . separated him from a major part of left-wing analysis of English society," and that "he did not want to see ecology as a scientific discipline justify leftist political theory."[2] This has created the misleading opinion that he "wanted to strike the word 'community' from his science's vocabulary," and that "Tansley's ecosystem, unlike the Romantic style of ecology [Goethe and Thoreau], dovetailed nicely with the agronomic and industrial view of nature as a storehouse of exploitable material resources."[3] Whereas one historian thus concludes that Tansley had a utilitarian management approach to both the conservation and exploitation of natural resources, another argues that he believed the British landscape "transcended economic utility."[4] What all historians of ecology seem to agree on, however, is that "[Tansley] depended upon the connection of the ecosystem to the physical sciences, the most precise and mathematical sciences, and the concept of physical equilibrium to convince his audience."[5] If not downright wrong, these views are inaccurate and anachronistic interpretations of Tansley's ecological project. Strangely enough, there are few, if any, references in his writings on topics of chemistry, physics, or mathematics; instead most references outside the realm of biology point to social psychology.

Arthur George Tansley and the British Botanists

This history of Tansley starts at the North London Working Men's College where his father, George, gave free lectures and carried out other unpaid educational work in an effort to overcome social ills among workers in the north of London by means of scientific education. He was a businessman when Arthur was born in 1871, and soon after decided to take an early retirement so he could devote his life solely to the promotion of science. This unselfish commitment to the value of science for workers and less fortunate people in society had a lasting influence on his only son Arthur.[6] Most teachers at the Working Men's College were organized into the Fabian Socialist Group under the direction of Frank Galton, who lectured on the history of trade unionism and the workers' right to own their own industries.[7] Tansley the younger recalls that it was a wood turner in this environment of socially concerned teachers that introduced him to botany.[8]

Tansley's father and mother Amalia Lawrence were anxious for their son to

go to one of the old and respectable universities. At the preparatory school at Worthing and at Working Men's College, they secured the best education for Arthur, especially in botany, which was important for potential medical students. At an early age Arthur developed editorial skills; when he was thirteen he became an assistant editor of *Westbury House School Ephemeris,* in which he wrote articles on botanical taxonomy.[9] At the age of fifteen he was sent to Highgate School for three years, where he complained about the lack of serious instruction in science and botany. As a result his parents decided that Arthur should attend University College, London, where he took courses from early 1889 until the summer of 1890 with Edwin Ray Lankester and Francis Wall Oliver.

Only seven years older than Tansley, Oliver was a promising botanist who had inherited his father's job as lecturer at the college in 1888, and advanced to professor of botany and chair of the department in 1890. Oliver was educated by Quakers at their school in Kendal, an institution known for broad-minded people, and Oliver was most definitely among their more radical graduates; he "remained throughout life something of a rebel, disliking all authority, rules and regulations and liked to be a law unto himself."[10] His administrative duties focused on restructuring the Department of Botany into a dynamic place for research, a project financed by a large grant from the Quain Trusteeship.[11] This plan included building a new laboratory, purchasing collecting equipment, establishing a new professorship, and organizing special lectures and colloquia.

With the help of this grant, Oliver transformed the department into one of England's most progressive locations for botanical research, attracting numerous students and scholars. It was also known as an arena for new ideas about educational and social reform, and as a center for scientific research aimed at curing social ills and injustices. A telling example is the department's support for aspiring women: Four out of eight recipients of the prestigious Quain Studentship between 1890 and 1927 were women; the College granted several doctoral degrees in botany to women, and nine out of twenty-seven members of the staff in the same period were women (four with a Ph.D.).[12] The educational policy of the London botanists was thus clearly on the side of women's equality at a time when such views still were controversial.

Oliver's major research project in the 1890s on the effects of "urban fog" on vegetation illustrates how he engaged with society as a socially concerned scientist. He employed several students and fellow researchers and collaborated with botanists in various industrial parts of England. The damage urban fog caused to plants was an "increasing source of dismay," Oliver explained, "something ought to be done . . . London suburbs are enshrouded in semi-

darkness, whilst the air is tainted with foreign and offensive matter."[13] He consequently carried out a detailed investigation of the chemical composition of urban fog and its injuries to plants, including comparisons of the sulfuric acid content of the air inside a greenhouse juxtaposed with air surveys inside and outside London. Although his practical solution was rather simplistic—building "fog-proof" greenhouses—his urban research does illustrate his interest in socially concerned botanical research that attempted to benefit society at large.

The botanists in London found their chief intellectual competitors in Scotland, where Frederick Orpen Bower was the driving force behind botanical research at the University of Glasgow. Bower came from a very different social background than his colleagues in the south; his friends could not help noticing the "Victorian atmosphere" that surrounded him throughout his life.[14] He was raised in a comfortable country home where he learned to appreciate the sublime pleasure of chamber music promoted by his father, a man of leisure and high society and a connoisseur, and by his mother Cornelia (the daughter of Rear-Admiral Morris of Beverley). It was through her brother, who was known for his impressive butterfly collection, that the young Bower learned to appreciate botany before he went to Cambridge. In 1880 he worked for one year as an assistant for Daniel Oliver at University College, London. Then he continued as lecturer under Thomas Huxley until he accepted the botany professorship in Glasgow in 1885.

Bower's close friend and intellectual companion was Isaac Bayley Balfour, the former Sherardian Professor of Botany at Oxford, who by 1888 was at Edinburgh University. Balfour had a social background similar to Bower's, and was known to focus on evolutionary explanations presumably learned during his assistantship to Thomas Huxley.[15] Together they developed an approach to education and research that emphasized plant physiology and morphological reconstruction of species. Much of this research on the evolution of species in relation to their environment was published in the volumes of *Annals of Botany,* edited by Balfour from 1887 until 1912. Also in Scotland was Patrick Geddes, who was known to use such concepts as "The Web of Life" to explain the biological evolution of human relations, first as a lecturer in Edinburgh, then as professor of botany at the University of Dundee.[16] Bower and Balfour dominated the field of botany. By the turn of the twentieth century, they were intent on establishing a school of ecology based in morphology.

The Londoners, with Oliver at the forefront, were looking for another path; their methodological point of departure in the 1890s had yet to differ radically from their Scottish rivals, but socially they were of a different caliber. It was in their environment of socially responsible botany that Tansley came

to know Oliver, his chief mentor and patron from whom he claims to have learned more botany than from any other person in his life.[17] His other teacher was Ray Lankester, a socialist and "a superb lecturer" with the unfortunate habit of lecturing during lunch hour.[18] Tansley thus could not fully appreciate the content of his courses, which ironically focused on theories of degeneration and extinction of animals.[19] Learning about the hardship of the struggle for survival was a bit too much for Tansley, who organized a student protest and campaign in favor of lunch instead of lecture. Lankester also participated in University College's élan for socially responsible science; he too wrote and lectured on the utility of botany for medicine by pointing to the importance of Louis Pasteur's work, as well as to the relevance of biology for both fishery and the improvement of human heredity.[20]

After nearly two years in London with Oliver and Lankester, Tansley entered Trinity College, Cambridge, in 1890, where he read the first part of the natural sciences Tripos (botany, zoology, and physiology). He went to Francis Darwin's and Walter Gardiner's lectures on botany, but felt he learned little that he had not already learned in London. Tansley was more involved in scientific research in the second year of the Tripos, and for this he was awarded a Trinity exhibition as a result of the intercollegiate examination of his work. In his final year at Cambridge he attended Thomas McKenny Hughes's lectures on geology, which included numerous field studies that later became useful in Tansley's ecological surveys. At the end of 1893 he completed the first part of the Tripos and placed first in his class and fifth among the candidates in aggregate marks.

These excellent academic results were not the outcome of intensive studies: instead one has to turn to his social life to see how his Cambridge experience reinforced his social views in a period when he was "absorbed in undergraduate activities of an intellectual sort, society meetings and interminable talks, often into the small hours."[21] He apparently owed more to his undergraduate society than to any other influence at the university: "I took my share of the usual interminable discussion on the universe—on philosophy, psychology, religion, politics, art and sex," he would later recall.[22] His friendship with Bertrand Russell had, in particular, a lasting influence on his intellectual development. Russell had become increasingly involved with the socialist Fabian Society (which he formally joined in 1897), and he associated himself with the views of Sidney and Beatrice Webb, George Bernard Shaw, Graham Wallas, and most important, Herbert George Wells.[23] The Blackman brothers Vernon Herbert and Frederick Frost (who shared rooms at St. John's College) were also among Tansley's best friends at the university. Their father practiced as a physician in the slums of London and their mother was the daughter of a medical superintendent of a prison, who struggled to

raise eleven children. Whereas the family could not afford to send Frederick and Vernon to Cambridge, they were nevertheless able to get an education there thanks to a generous donation from the wealthy husband of their aunt.[24] At Cambridge they decided to follow their father's admirable work by studying medicine so that they too could be useful to society's poor. Another close friend of Tansley's worth mentioning was Frederick William Keeble, a son of a cabinetmaker in London.[25] The Blackman brothers, Keeble, and Tansley formed a kind of clique, and would often discuss how education and science could improve a society divided by economic inequality.

After three years at Cambridge, Tansley returned to University College, London, because of a tempting offer from Oliver to work as his assistant. Tansley readily accepted the job and worked there from 1893 to 1907, doing a variety of research and teaching in palaeobotany, plant anatomy, and ecology. This job did not prevent him from continuing his studies at Cambridge; he finished the second part of the natural science Tripos in 1894 with botany as the main subject. He also helped Herbert Spencer revise his *Principles of Biology* for a second updated edition, which was released in 1898.[26] During his years in London, he shared a flat at the Old Ship Hotel with Vernon Blackman, who worked as an assistant in the Natural History section of the British Museum and as a lecturer at University College.[27] Together they experimented with vegetarianism as a healthier diet by frequenting Eustace Miles's restaurant daily, which was known not only for its all-vegetarian menu but also as a meeting place for socialists and London's counterculture. Perhaps Tansley even learned to appreciate opium in this environment.[28] At the restaurant Miles advocated the new vegetarian avenues to social health and sold books exploring the connection between the brain, muscles, and diet. He gave lectures every Thursday as well as advice to his customers on how to begin his regimen, and upon leaving the restaurant a client could pick up free leaflets containing vegetarian recipes. It is likely that Tansley's later interest in the relation of psychology to social health had its origin around the tables of this restaurant and in reading Miles's popular books and pamphlets.[29] It was while eating vegetarian meals that Tansley's circle of University College students and scholars discussed their educational program focusing on the importance of socially concerned research.

As lecturer at University College, Tansley also showed concern for his students through his involvement in the Student Union. Traditionally young lecturers took the responsibility of leading the union, and Tansley served as vice-president, then later as president (1898–1900), and finally as the union's treasurer.[30] The Student Union's mission was to organize lectures, orations, and formal dinners, as well as to address questions of concern to the general student body. Tansley seems to have taken the welfare issue especially seriously in his term as president; items on his agenda included the need for a student lounge, better food, improved athletic facilities, and improvement of heating and ventilation of the libraries.

He described his London years as happy ones, and his entertaining lecture, "The Origin of Death," from 1898 is surely evidence of a man in a good mood, displaying charming British irony at its best.[31] His diary from his half-year tour to Ceylon, the Malay peninsula, and Egypt between 1900 and 1901 also tells of a young man excited about exploring the world. The voyage was important for Tansley's career—all ambitious scholars had to make such a voyage if they wished to scale the hierarchy of British botany. Tansley consequently published a paper on his findings.[32] Upon his return the *Gazette* reported that he "danced to the very last extra" during the annual prom of 1901, and he even wrote an article praising the women in Cambridge, whose "feet and ankles are proverbial . . . and hockey skirts are short."[33] It was during this happy period of his life he fell in love with his former student Edith Chick (the first female student to receive the Quain Studentship), whom he married in 1903. Her article about seedlings of nutmegs soon found its way into Tansley's *New Phytologist*, and she was also among the staff of University College for some time.[34]

Ecology Arrives in Britain

In 1894 Tansley learned German and subsequently discovered Eugenius Warming's book about plant societies through the 1896 translation from Danish. Warming "opened . . . a new way of looking at the plant world" for Tansley, and he devoted his time almost entirely to ecology from then on.[35] He frequently suggested that British botanists should base their approach on the work of German and Scandinavian ecologists. Balfour was equally excited about Warming's book, and the tension that eventually developed between him and Tansley had to do with how to conceptually understand the ecology Warming pursued.

Warming was an admirer of Alexander von Humboldt, who in his books about plant geography relied on morphological methods as well as traditional systematic botany.[36] The focus in the original Danish edition of *Plantesamfund (Plant Societies)* of 1895 and the first German translation was not on morphology but rather on how to understand the geographical distribution of plants by analogy to human society and economy.[37] This correlation was not accidental; Warming and his students sought to develop an ecological method suitable for Danish imperialism. Ordering nature in a colony into one economy was important for achieving environmental control in a foreign region.[38]

It was precisely the ordering of plants according to geography and economic method that intrigued Tansley. He was not against morphology as such when he first read Warming, and the tension that developed between Tansley and Balfour did not become apparent until Tansley learned to appreciate genetic and biochemical research upon his return from Egypt in 1901. Tansley started to promote the idea that the genetic origin of plants was rooted in soil formations and that physiography was thus the correct ecological approach, whereas Balfour stuck to the morphological study of tracing the ancestral history of species as a methodological basis of ecology.

Warming himself did not believe in the value of the genetic origin of plants, and the subsequent German editions of his book grew with a six-hundred-page morphological enlargement in its final version of 1918.[39] This elaboration disturbed Tansley but pleased Balfour, who arranged to translate the first English edition. Warming, working with an assistant, wrote a fully revised manuscript for Balfour to translate; he also updated the morphological content by borrowing from the German versions. Balfour thus claimed in 1909 (with Warming as the authority) that proper ecology used the morphological method, that he as Warming's translator was defending the correct ecological approach, and that Edinburgh was the center for such ecological research.[40] Henry Cowles at the University of Chicago was much pleased with the morphological turn of ecological methodology, but Tansley wrote a long critical review of the English edition, in which he advised his readers to stick to the first German version.[41]

Tansley's critical review of Warming's later work was published in *The New Phytologist,* a journal he founded in 1902 to promote new approaches to botanical research.[42] It was a blend of current research reports and a newsletter, published on a monthly basis. Tansley serialized important articles to ensure continued readership and a permanent circulation. Many articles thus end with "to be continued." Besides the serial articles, Tansley published book reviews, correspondence, debates, miscellaneous notes about other journals, seminars, textbook suggestions and other relevant news. His aim—to create a sense of scientific community—was soon achieved. One had to read the journal to know what was going on among progressive British botanists. The first volume has several articles (probably written anonymously by Tansley) with a content appealing to a broad scientific audience: "Ecological Notes" (review of current ecological research), "Toward an Ideal Botanical Curriculum," and "The Meeting of the British Association" (reviews of botany papers). Some of these reviews pointedly name-drop, to make sure that all potential subscribers are mentioned.

Tansley's growing number of subscribers received a journal whose radical views promoted new approaches to botany and which explored how botany

might serve society. The editorial policy of the first fifteen volumes provided a forum for the new generation of botanists, with, for example, articles about Mendel's laws.[43] The journal did not participate in the fiftieth anniversary of Darwin's *Origin of Species* in 1909, but instead published numerous articles about Mendel. Neither did Tansley curry favor with the old generation of established scholars by begging them to subscribe and publish; instead he made reference to the Darwinian struggle for survival by dismissing ". . . kindly but mistaken 'loyalty' which prompts some people to support a magazine which they do not want, or which has outlived its claims to recognition."[44] The acceptance of his girlfriend's paper in *The New Phytologist* was not an act of generosity, but a serious attempt to create a forum where young scholars could publish their first articles. This patronage of a new generation of botanists explains why Tansley later became such a father figure to so many British ecologists.

Tansley's journal had stiff competition in *Annals of Botany,* which was edited by Balfour. His editorial policy tended towards the morphological tradition. Here established and respected scholars published articles and commented on each other's greatness until the journal had the unmistakable flavor of a forum for retirees.

The rivalry between ecologists in London and morphologists in Scotland created tension over how to understand the history of botany. Oliver was as eager as ever to show that ecology was at the cutting edge of history as well as science, and consequently in the spring semester of 1911 he invited several botanists to give lectures on the history of British botany that were designed to place ecology at the scientific frontier. The series started off with lectures on Robert Morison (1620–1683) and John Ray (1627–1705), and continued with Nehemiah Grew (1641–1712), who "seems to have been alive to the importance of the ecological standpoint." These were followed by descriptions of alleged forerunners of ecology such as John Stevens Henslow (1796–1861), whose research "lay in the direction of what is now called Ecology," and William Graffith (1810–1845), who thought in terms of ecology "long before ecology was invented." The whole point of the series was to construct a history that would venerate ecology, "so that a new sphere of usefulness is opened" to taxonomists, botanists, and natural historians.[45] Such a reconstruction of history displeased George Sarton, an historian of science, who wrote a critical review of the lectures in the first volume of *Isis* when they were compiled into a book.[46] Bower and Balfour were also invited to lecture and they naturally chose to focus on how morphological botany in Edinburgh led to ecology.

Although all the contributors agreed that ecology was at the forefront of history, there was still a schism over whether this front was genetic or mor-

phological. The immediate answer came a year later when Joseph Reynolds Green published a history of botany in the United Kingdom ending with a long tribute to Balfour, Bower, Scotland, and morphology.[47] Robert John Harvey-Gibson got the last word when he wrote a balanced account, *Outlines of the History of Botany,* that identified morphology, taxonomy, and ecology as different historical paths (surely a gentleman's way of describing the general upheaval in the scientific community).[48]

The emerging conflict between the two approaches to ecology included methodological, social, and educational differences. Morphology in Edinburgh was taught with professorial pomp and authority in large auditoriums, with laboratory training on the side. Laboratory work was also part of the Londoners' curriculum, but the teaching was done in small seminars and special courses. After 1905, most ecological training took place at field stations, where plant geography played a much more important role than plant morphology. The highlight for London students was to spend their summers studying sand dunes at Bouche d'Erquy in Brittany or (after 1913) at the seashore at Blakeny Point in north Norfolk. Here they enjoyed the dunes, a field laboratory, and student parties in the university's lifeboat houses, where lasting friendships were built and romances unfolded.[49] Tansley's growing interest in ecology took root on these expeditions. He assisted Oliver in his research on French and British sand dune vegetation, salt marshes, and shingle beaches in collaboration with Edward James Salisbury, the likely author of the following limerick about Oliver:

> A certain Professor of Botany
> To save his class from monotony
> Led his students a dance
> Round a salt marsh in France
> To develop their brains
> If they've got any.[50]

The verse reflects an informal jocular research culture different from Edinburgh. Indeed, Salisbury, in his obituary of Oliver, recollected all the amusement they had enjoyed, taking "short-cuts" at night over cucumber frames in the private gardens. (The next morning the owners would ascribe all the broken cucumbers to vandalism by outraged suffragettes.)

Patronage of an Ecological Survey of Britain

In the period leading up to the Great War, Tansley was known not as a researcher, but rather as a skillful organizer of scholarly activities, editor, and lecturer in botany at the University of Cambridge. The historian of ecology

Laura Cameron has reviewed Tansley's research activities while he was lecturing at Cambridge and shows in an excellent study that he was the main force behind the Cambridge Ecology Club, which carried out research at Wicken Fen nature reserve.[51] He soon controlled the growing ecological debate in Britain through his editorial work, as secretary of several meetings of the botany section of the British Association for the Advancement of Science, and as leader of ecological societies and committees. Most important of all these activities was his organization of an international ecological excursion around the British Isles. Such an ecological survey had long been sought by Tansley, and in 1911 he mobilized his colleagues to form the Central Committee for the Survey of British Vegetation and to carry out his plan.[52]

In retrospect, historians agree that the excursion became the formative event for modern plant ecology in Britain.[53] What historians have failed to discuss is the importance of the survey's patron George Claridge Druce and the genetic approach of the survey: the ecologists sought to ground the history of vegetation types in soil formations around the British Isles to determine the ecological relations of plants on the islands.

Druce was one of the founders of the Ashmolean Natural History Society of Oxfordshire, the author of an account of the flora from the region, an active Freemason, the leading pharmacist in Oxford, and the former mayor of the city representing the Liberal Party.[54] He was a rich gentleman who challenged the hegemony of the town's university by focusing on how science should serve society (as in, for example, his pharmacy). Tansley and the Blackman brothers fully agreed; they had long advocated that science should serve society, and cooperation with pharmaceutical interests could prove their point, especially with a patron like Druce who did not belong to the conservative establishment. Tansley had long been in correspondence with Druce on this issue. He had tried (on the occasion of Druce's election) to get him to contribute to the first volume of the *New Phytologist,* but Druce was too busy.[55] When Tansley proposed to carry out an international phytogeographical excursion around the British Isles with all the major ecologists, he turned to Druce for financial support.[56] Druce became the excursion's unofficial guide (a task he carried out according to Tansley with "kindness and good humor"), and he even published the floristic results from the journey.[57] The ecologists raised more money than they needed, and spent the surplus on costly banquets and luxury hotels. Exclusive dinner cards made especially for the excursion reveal sumptuous menus of French cuisine, prearranged seating, a carefully planned order of toasts, and extensive wine lists.[58] The foreign members of the party were overwhelmed when their British friends at the dinner at the Royal Hotel in Truro proposed after a cabinet of custard puddings, stewed fruits, trifle, jelly, and creamed meringues to toast

and sing "I dream of thee" in their honor (followed by a violin playing "meditations" by Squire). Afterwards the party would sign Druce's dinner card with remarks like "for kind remembering" or "with love" as a special tribute to their generous patron. All the extravagance was of course prepaid; the participants had only to contribute a small fee and bring their evening dress as well as a dark suit for the dinners.[59]

The old saying "There is no such thing as a free lunch" was also then a law for ecologists.[60] The Swedish participant Carl Lindman, for example, thanked Tansley for the pleasant summer lunches by sending him the picture book *Sweden Through an Artist's Eyes.* He also wrote an article praising the survey and Tansley's role in it for the *New Phytologist,* and invited Tansley to Stockholm.[61] The other international participants reacted in similar ways, and Druce received letters of appreciation from ecologists that indicated loyal support and close friendship with the Oxford pharmacist and politician.[62] Several upon their return home wrote flattering reviews of the survey for the *New Phytologist,*[63] and Tansley in turn compiled them into a costly private leather-bound edition that he gave to Druce. Druce's patronage created an intimate relationship between the pharmaceutical economy and ecology. Druce had by his patronage added many of the leading ecologists to his social network, and could mobilize them when needed for pharmaceutical research.

The results of the excursion were published in a celebrated monograph by the Committee for the Survey of British Vegetation in 1911 as *Types of British Vegetation,* dedicated to Warming as "the father of modern plant ecology."[64] Tansley wrote the main theoretical introduction to the book and edited individual contributions from the committee. He was careful to point out that their ecological approach was new and different from earlier classifications of British vegetation. Instead of a taxonomy of plants based on individual species, the ecologists classified plants according to geography and relations to other plants. The difference between ecology and natural history was that ecologists established their taxonomy based on factors in the habitat, such as climate, geology, and the soil, whereas natural historians classified plants according to what Tansley saw as the outdated concept of a great chain of being.[65] The opening chapter of the book describes the physical character and climate of the British Isles, including maps of hard and soft rocks, heights above sea level, distribution of rainfall, sunshine, and influence of warm and cool air. The subsequent chapters elaborate on different types of soil, distribution of rocks, and so on. After laying out these features of the British habitat, the committee began to describe the distribution of different types of vegetation, starting with the forest.

The chapter on forests is particularly striking since it builds on a long debate on the issue of English deforestation. "The British Isles was originally

covered with forests," the authors explain, but with the introduction of the human community the forests gradually disappeared, since the human community was "the natural and inevitable enemy of the tree-communities of the countries it inhabits."[66] There was thus an imbalance between the trees and human civilization. The formation and degeneration of oak forests and woodland occupy a good part of the book, which established that a forest climax "before the beginning of the historical period" had "degenerated into heathland during the last few centuries."[67] Subordinate, retrogressive, or degenerating associations of woodland had been brought about by too much felling of trees, grazing, and, above all, "the absence of any definite system of re-planting."[68] There is a romantic strain in this argumentation; the task of ecology was to save British civilization from itself by returning to the original state of forest community. This theme, which Tansley reiterated throughout his life, supports his role as a socially concerned scientist.

What is also striking about the book is its commitment to genetics and rejection of an evolutionary approach to ecology. Clearly, Tansley wanted to fashion ecology as a new and progressive science that rejected what he thought to be outdated morphological theory; all of the book's ecological diagrams show lines of affinity indicating genetic derivation grounded on types of soil formations within the plant communities.[69] The contrast to the research of Balfour and the later Warming could not be starker.

Botanical Bolshevism

The outcome of the collaboration on the monograph was the foundation of the British Ecological Society in 1913 at University College, London, with Tansley as the first president. The activity of the society's first years was seriously hampered by the Great War. Tansley was studying the relation between Alpine and Mediterranean vegetation in the Alps when the war broke out.[70] His unpublished notes from the period reveal that he was working on how to classify vegetation into ecological "zones" based on a climatic classification system of temperature, humidity, altitude, frost, and so on.[71] This theme, which some years later would dominate Charles Elton's work on animal ecology, was an attempt to break away from traditional botanical classification systems.

Tansley discovered that he was too old to enroll as a soldier and that there was hardly any teaching at the universities, so he was assigned to do routine clerking in one of the government ministries.[72] In his leisure time he cultivated a friendship with two young psychologists named Wilfred Trotter and Bernard Hart, who introduced him to the works of Freud. Tansley's election as a Fellow of the Royal Society in 1915 seems to have been one of the few

bright spots in a dark period of his life, especially since Balfour and Bower may have halted his nomination for several years.[73] From December 1916 Tansley edited the British Ecological Society's own *Journal of Ecology* while also continuing to edit his *New Phytologist,* which contained several moving obituaries of promising students who died in the war. In order to be of some use to his country, between 1917 and 1919 Tansley led the Scientific Research Association, whose task was to contribute to solving postwar problems. The association was, according to Harry Godwin, a major concern for Tansley during the concluding stages of the war and illustrates his sense of social responsibility, but his concern for the public did not materialize in national support for the association, and it was thus closed down.[74]

In this postwar period both Oliver and Tansley became increasingly engaged in environmental protection by joining the Society for the Promotion of Nature Reserves.[75] The best means to cope with the country's war trauma, they believed, was to construct and protect a healthy environment for the people. This is most evident in Oliver's contribution to the reconstruction of the country of 1918. Together with Alfred E. Carey (a fellow of the Royal Geographical, Geological, and Chemical Societies) he published a book on how to manage, improve, construct, preserve, and embellish the British shores. This remarkable study, which summarizes the social relevance of Oliver's research, outlines how the marine engineer can utilize ecological knowledge about sand dunes to build a beautiful wilderness along the British shoreline. They advise on how to create plant communities that hinder the notorious wandering of sand dunes, discuss how to construct sand dunes as environmental fences for devastating wind, outline ways of reclaiming land and beaches lost to the sea, and debate various initiatives against soil erosion. The book ends with a fierce critique of capitalistic enterprises that buy up sand dunes and beaches for construction purposes to the detriment of local fishing communities.[76]

Meanwhile Tansley lectured on botany at Cambridge, but his belief in the social aim of science did not resonate with the more conservative dons he now engaged with. Worse, in Cambridge they were mainly doing comparative morphological studies instead of those genetic, plant-physiological, biochemical, and ecological studies Tansley supported. This had earlier resulted in tension between Tansley and his colleagues; back in 1912 he prepared an application for a professorship in botany at the University of Sydney to vent his frustration, but his colleagues were apparently unmoved.[77]

The conflict between the geographical and morphological camps was finally spelled out in a heated debate from 1917 to the spring of 1919 in Tansley's own *New Phytologist.* It began with a manifesto for the reconstruction of botanical teaching signed by the Blackman brothers, Keeble, Oliver,

and Tansley.[78] They were still close comrades; Frederick Blackman had just married Elise Chick, the sister of Edith Chick (now Tansley), and thus became Arthur's brother-in-law. Tansley was also a frequent guest in Vernon's home, where besides discussing politics he would entertain their small son Geoffrey Emett with botanical rarities.[79] As the Bolshevik October Revolution in Russia filled the news they decided that the time was right to question the social value of morphological science and education for society.

At the heart of the matter was the issue of whether scientists rightly belonged within the world of labor and thus whether they should support the National Union of Scientific Workers.[80] They were skeptical about the union because the Executive Committee consisted of fierce revolutionaries without respect for the all-important democratic basis of a free society, but they nevertheless thought the general aim of such a union was admirable. The academic status of botany, they argued, was "not only unsatisfactory, but even dangerous," their salary was "absurdly low," and their field was dominated by outdated morphological biology hopelessly tracing evolutionary developments of plants.[81] The authors suggested focusing on an approach to botany that was "something broader, more vital and more practical": Morphological "intellectual activity divorced from practical life tends to what is called 'academicism,' whose characteristic vices are formalism, pedantry, and hair-splitting." They do not understand that "the human mind, like the human organism as a whole, is primarily and fundamentally a mechanism for getting things done, not for abstract thinking and the pursuit of knowledge for its own sake."[82] The pursuit of science, the manifesto announces, should not be divorced from real life: "Further, and this is also of great importance, practical life offers for solution a large number of problems which actually interest the greatest numbers of [scientific] workers." Morphologists should connect "the spirit of science and the spirit of practical life," and since the country is in a state of war it was time "to readjust our intellectual ideals . . . on sounder lines."[83] The authors made it clear that they did not suggest any "patching" of the existing botany, they wanted no less than a total reconstruction of botanical teaching with "a new spirit and a new ideal" along genetic lines.[84]

The Scottish morphologists were outraged. Bower in particular had reason to be upset since he was about to prepare a new textbook on botany that clearly did not fit with the manifesto's ideals for reconstruction of elementary botanical teaching.[85] Indeed, Tansley would later publish an unusually harsh criticism of Bower's book in his journal.[86] The tone of the debate became hostile. In one fictional dialogue, for instance, The Five Wise Men (the authors of the manifesto) examined their biological-morphological opponent by asking mocking questions like "Have you ever heard of ecology?"[87] Some of the responses to this criticism came from Tansley's morphologically ori-

ented colleagues. They were not pleased. One sharp criticism of "the five wise men" came in the form of "a plea for freedom" from "revolutions" in botanical teaching,[88] and Bower argued that his opponents "appeared to advocate immediate *Botanical Bolshevism* . . . That is the spirit that has ruined Russia, and endangered the future of civilization."[89]

Now, "the five wise men" did not praise communism, Bolshevism, or the Russian Revolution. Oliver's reply to the criticism was more modest, saying that "we need to develop the applied side . . . thus gradually building up a connection with industry."[90] Yet the conditional endorsement of the National Union of Scientific Workers, of better salaries for botanical workers, and of a strong connection between scientific and practical life had a clear socialist aspiration. Tansley's background and education at North London Working Men's College and University College, London further highlight this reading of his political views, which in many ways resembled those of other ecologically inspired writers such as Julian Huxley and Herbert George Wells (see Chapter 3). This was an academic form of socialism that blended utilitarian philosophy of economy, social responsibility, and a strong belief in the utility of science for society at large. There is no evidence in either published or private material that Tansley or any of his friends promoted revolutionary ideas, and if one looks at Fabian socialism at the turn of the century it seems clear that its adherents were generally against anarchism, Marxism, and revolutionary activity. Rather, they were committed to building a welfare state by democratic means, with an emphasis on solving practical problems for the benefit of society at large. Their goal was to provide a socialist critique of free-market capitalism through a vision of a society managed by economic planning and social engineering, based on the advice of scientific experts. In their handling of the ideas they did not dismiss elitism and imperialism, since experts and scientific planners could help in raising poor colonies to a higher level of material and intellectual life.

The aftermath of the debate was detrimental to Tansley, who at the time was a candidate for the vacant Sherardian professorship of botany at Oxford, for which his friend Keeble had also applied. Unfortunately for Tansley, Balfour was on the Board of Electors for the appointment, and he firmly believed that Tansley was the main author of the manifesto. Consequently, when he realized that none of his own favorite students had applied for the chair, he convinced the board that the obviously less qualified Keeble was better for Oxford than the chief advocate of radical educational reform. "I laughed in my sleeves," Balfour wrote to Bower. When the value of Tansley's manifesto was mentioned at the meeting, Balfour knew he was about to impede the man's career.[91]

A New Beginning: Tansley's Turn to Psychology

Tansley was devastated when the news came from Oxford. For the better part of his life he had worked harder than anyone else to establish the field of ecology and to promote new approaches to botany, but the Oxford dons would still not accept him. Disillusioned with his life and career (or lack of such), he turned to psychology partly as a personal therapy, but also to be of some help in a society shattered by war. The result was his book *New Psychology and its Relation to Life,* published in 1920.

At the age of forty-nine Tansley finally experienced his first major public success; this book received flattering reviews in all major newspapers and intellectual journals.[92] What caught the public attention was what several reviewers found to be a scandalous psychological explanation of God and sexual sin, about which Tansley soon found himself in the midst of controversy.[93] The counterculture of occultists, feminists, socialists, and educational reformers were, on the other hand, very pleased with the book.[94] Yet Tansley got the highest praise from revolutionaries, who saw his analysis of social herds as a "remarkable" psychological explanation of a Marxist understanding of class-consciousness: "In conclusion, we reiterate our recommendation of this brilliant volume. Every class-centre should add the book to its library. All Plebeians who can beg, borrow, or steal a copy should hasten to study *The New Psychology.*"[95] Indeed, the book soon became a bestseller that appeared in no less than eleven editions and was translated into both German and Swedish.

The success of the book owed partly to Freud's fame, and Freud's close collaborator Ernst Jones naturally wrote a long and very favorable review of Tansley's book.[96] Jones recalls, "Freud's name was becoming a household word in London at this time. In January [1922] his photograph appeared in the fashionable weekly magazine, *The Sphere*. But publishers had to beware of the police . . . in those days sexuality and psychoanalysis were interchangeable concepts."[97] Some of Freud's books were withheld from the public because of their "offensive" sexual content; the translation of his study of Leonardo da Vinci, for example, was only accessible to people in the medical profession. Tansley's book was thus received by the general public as a thriller exposing hidden sexual forces in human societies that the government tried to hide from the public. All this attention helped to establish Tansley as a scholar outside the closed circle of botanists and ecologists. He frequented psychology circles and lectured on Freud's theory of sexuality before the British Society for the Study of Sex-Psychology.[98] His book was a popularized explanation of such clinical psychology, and was aimed at a broad audience. He was taken by

surprise, however, when he discovered that it was used as a textbook for students of the topic. The aim of the book was rather consistent with his general urge to contribute to the public good by addressing questions concerning "great human problems and activities" in postwar Britain.[99]

Tansley's theory of psychology is largely a synthesis of Freud's psychology and a discussion (as the title suggests) of how it relates to life. The human mind, Tansley argues, follows the laws of biology, and these laws are allegedly best expressed in Freud's psychology. Tansley saw in his psychology a theory of how psychic energies search for an unconscious equilibrium within the mind and ultimately within society.

What is the relationship between the mind and its brain? Tansley was unable to solve the deep philosophical problems related to this question, and instead of becoming lost in the labyrinths of philosophy he found a practical solution: He used analogies "from our own experience of the external world" in his explanation of the internal mind: "The justification of this apparently illogical and contradictory procedure is simply scientific utility . . . If we can make some progress in reducing the bewildering complexity of mental phenomena to something like order, . . . [then] the means by which we obtain these results are fully justified."[100] Tansley bluntly agreed that using concepts from the external world on the mind is an illogical and contradictory procedure, but he defended his method as justified because it produces something like order in the complexity of the mind. The justification for this illogical procedure was the practical importance of establishing law and order in a state of insanity and disorder.

Tansley started building the practical bridge between mind and body by pointing out the importance of inherited instincts.[101] Although these instincts are the product of biological evolution, Tansley carefully avoided the historical fallacy by stating that knowledge of inherited instincts does not explain the entire human condition. Instincts were fundamental to Tansley; they "determine the ends of all [mental] activities," they "form the groundwork of the whole structure of the mind," and they represent "the beasts that perish" within us, and "the plan on which the mind is built."[102] Tansley's next step was to focus on how sense stimuli from the external world caused reflex actions that unconsciously determine the development of instincts.[103] Such minor and major responses among individual instincts were for him the key to understanding the evolution of species.

Numerous stimuli-response charts for simple organisms as well as the human mind illustrated the interaction of an organism with the environment (see Figure 1). The chief metaphor in these illustrations was that of explosions. The first of Tansley's figures shows how stimuli are like an "action of a detonator" triggering an "unstable substance with stored energy," which

causes an "explosive discharge of energy" as a response.[104] The image of an explosion is used to explain how stored energy responds to different stimuli. Tansley's Figures 3 and 4 are images of more complex organisms with a sense organ, indicating how stimuli and responses interact with the help of a motor mechanism in a central nervous system. The explosion has been converted into a "motor mechanism." Notice also that "the space within the inner circle," in his Figure 4, "represents the mind, [and] that between the two circles the body." Tansley is careful to separate the mind from the brain. Stimuli from the objects on the sense organ go through the body in tubes into the mind, which, with the help of cognition, affect, and conation, produces a coordinated motor response. In his following figures Tansley would use basically the same model, only with more stimuli and responses to indicate higher mental processes and a higher conation.

The brain is filled with unstable stored energy that explodes like a combustion chamber, and out of the brain tubes comes psychic energy or a stream of consciousness. This stream can be either fore-conscious, conscious, or unconscious, Tansley explained, depending on external sense stimuli and on whether the person is awake or asleep.[105] These forms of consciousness in the mind structure are hereditary, and the environment can only change their intensity. Within the mind there is an associative network ("tubes") between the mental elements ("explosions and combustion chambers"), seen in his Figure 7, in five different clusters. Some of the clusters are in a state of activity *(b)* while others only produce unconscious energy *(a)*, often with the help of sub-clusters *(a′)*. Tansley's Figure 7, "The associative network of the mind," is particularly important to the argument of this book. I will later argue that Tansley projected this model of the mind into ecology, and that this figure thus represents the very origin of the ecosystem concept.

In the book Tansley outlines how the psychic energy in the mind-network flows in channels of conation that constitute a person's libido. His text is virtually flooded with channel, water, and dam metaphors, all of which are supposed to explain how energies flow from one level of consciousness to another in the mind machinery. The mind will always try to direct its energy towards equilibrium and balance. The feeling of injustice, for example, is caused by an imbalance of energy in the mind structure, and only stimuli in the form of compensation, revenge, or punishment can restore the lost "mental balance" and hence create a feeling of justice.[106]

The mind is not alone; its channels reach—with the help of stimuli and responses—other minds and hence create social channels, clusters, and networks. Tansley explains that besides artistic, philosophical, and scientific networks, "the immense complexity of modern civilized life provides numerous other channels for the employment of psychic energy."[107] The mind's social

life includes primary channels that secure biological needs, secondary utilitarian channels that measure psychic cost and benefit, and luxury channels for pure enjoyment of life. Most important, the economy of psychic energy must be in balance with its environment:

> If the mind were a perfect machine, an organism completely adapted to its environment in every detail, this would represent a fairly complete biological description of its structure and mode of action. But the human mind is very far from perfect, and the smoothness of its working is in fact constantly hampered by faltering purpose, mental conflict, and the refusal of the world to lend itself to the gratification of the heart's desire.[108]

This is a daring observation. The mind is insufficient; its psychic energy cannot satisfy all the demands from the external biological world. The mind's brain as well as the social and physical environment refuses "to lend itself . . .

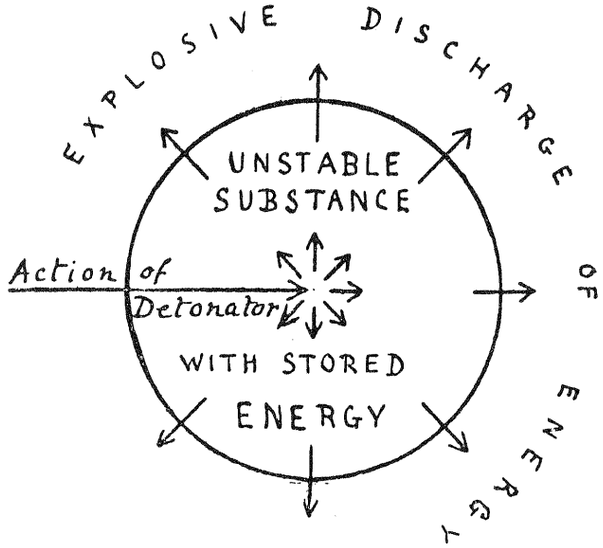

FIG. 1.—DISCHARGE OF ENERGY FROM UNSTABLE SUBSTANCE (HIGH EXPLOSIVE) STARTED BY THE ACTION OF A DETONATOR.

Figure 1. Illustrations and original captions from Arthur George Tansley's *New Psychology* (1920) indicate his view of the motor mechanism of the mind and the brain. Tansley would use the model of the brain as an analogy to his ecosystem theory. Reproduced courtesy of HarperCollins, UK.

to the heart's desire." Tansley uses this picture to explain abnormal human behavior such as insanity, immorality, and decadence in terms of lack of psychic energy, energy gone astray, or energy out of balance. It is not always clear whether he is writing about the mind, society, or the environment, but he is certain that this world consists of channels of energy: cognitive, emotional, conational, normal, abnormal, easy, uneasy, new, old, sexual, plain, deep, narrow, or smooth. These channels explain who we are and where we belong. The major metaphor for energy distribution in this network is balanced or unbalanced equilibrium. Tansley uses different examples to explain the balance of an officiating mind. One such example is that of efficient management of a committee by an effective chairman.[109] A good mind always tries to

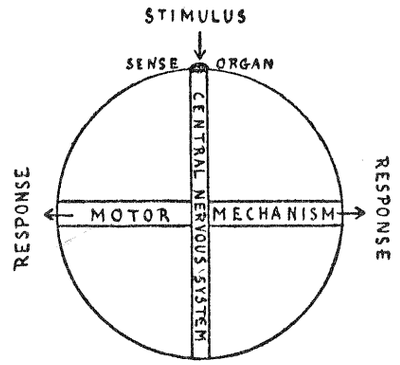

FIG. 3.—SPECIFIC RESPONSE. TYPE OF REFLEX ACTION.

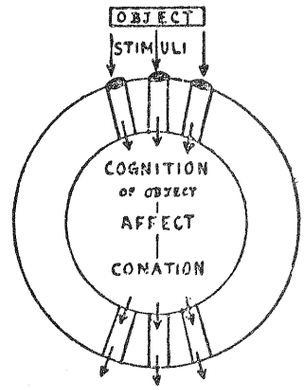

FIG. 4.—SPECIFIC RESPONSE. TYPE OF INSTINCTIVE ACTION WITH PSYCHICAL CONCOMITANTS. The space within the inner circle represents the mind, that between the two circles the body.

FIG. 4.

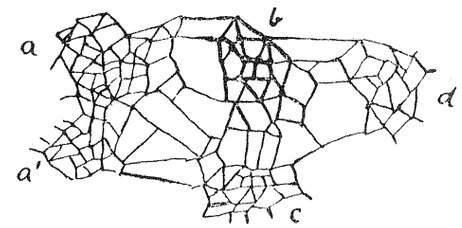

FIG. 7.—PART OF THE ASSOCIATIVE NETWORK OF THE MIND SEEN, AS IT WERE, IN SURFACE VIEW (compare Fig. 8, p. 51). Five complexes are shown, of which *a'* is a branch or sub-complex of *a*. The complex *b* heavily lined, is supposed to be in a state of activity.

restore a lost equilibrium, and a good leader always tries to create a well-organized herd out of a messy crowd. It is likely that Tansley was inspired by Herbert Spencer, although he does not refer to him, since some of Tansley's writings about equilibrium of the mind and the social herds resembles Spencer's principles.

The primary force of the mind or the instincts is an ability to form *systems* in the form of either ego systems or social systems.[110] The primary instinct creates an ego system that roughly corresponds to an equilibrium of psychic energy in the brain's network of channels. The herd instinct, on the other hand, creates social systems because the human by (biological) definition is "a gregarious animal." "The normal individual man," Tansley explains, "*must* obey suggestions arising from his social unit, or he will be as miserable as if he is physically cut off from human society."[111] In order to illustrate how closely the social system of a human herd is integrated, Tansley mobilizes a whole range of biological metaphors. Human herds are like bee communities, animal organs, social organisms, or animal communities, and "we meet the same sort of division of labor between different classes of the [human] community, as we find among organs and tissues of the animal body."[112] This naturalization of the human condition implied that biological laws could explain behavior of human herds. Moreover, "the whole system of morality and the moral law are the direct outcome of herd organization, and the felt obligation to obey the moral law is a direct expression of the herd instinct."[113] From Tansley's point of view it was thus just and fair to severely punish "the so-called 'conscientious objectors' to military service in the Great War." In fact, for Tansley it was questionable whether such a thing as personal conscience existed, since "morality is *primarily* a herd concern."[114] In short, morality and social behavior were controlled by the herd, and in the herd everything is a question of network, conventions, etiquette, and good form.

Much more could be said about Tansley's theories of the evolution and degeneration of herds, or of partial herds, universal herds, and insane crowds. Briefly, Tansley's *New Psychology* represents a blend of biology and mechanism. He seems to build on a long British tradition of explaining ethics in terms of sentiments and feelings instead of reason, although he places more emphasis on the social instinct than on private sentiment in traditional utilitarian epistemology.

The success of his book and the help of Ernst Jones brought Tansley to Freud and Vienna in the spring of 1922.[115] There Freud psychoanalyzed him through the spring and summer, and noted in a letter to Jones that "I find a charming man in him, a nice type of the English scientist. It might be a gain to win him over to our science at the loss of botany."[116] Tansley for his part threw himself into working at Freud's side. He was so convinced of his shift

of career and need for psychoanalysis that he resigned from his university lectureship at Cambridge in 1923 and emigrated to Vienna with his family, where they stayed for six months. Here Freud analyzed his anxious dreams about being lost among South African native tribes only to be saved by his wife.[117]

Though he carried out some botanical research in Vienna, he decided to abandon botany when he moved back to Grantchester and started to practice as a psychologist. Freud referred two neurotic patients, who Tansley treated for two years before he gave them up.[118]

Although Tansley gave up psychology as a profession, he kept his interest in the subject throughout his life. In the summer of 1925, for example, he engaged in a long and bitter polemic in defense of Freud based on his favorable review of the first English edition of Freud's collected papers.[119] His subsequent defense of psychology will be one of the topics of Chapter 4, in which I consider Tansley's contributions in the 1930s at the Magdalen Philosophy Club, Oxford, and again in Chapter 6, in which I discuss Tansley's lectures on psychology in relation to freedom in science and his belief in the importance of nature conservation and preservation for the human mind.

From Psychology to Ecology

After naturalizing the human mind in his psychology, Tansley turned towards a process of humanizing nature in his ecology. This circulating argumentation is most evident in a 1920 article written shortly after his book on psychology, where Tansley developed a method for classification of vegetation based upon comparison with human communities. The justification of this illogical argument by analogy is again its utility.[120] Tansley coined and explained ecological terminology and taxonomy through a variety of analogies to social psychology: The development of plant associations finds its analog in the development of an individual organism; phylogeny of plants recapitulates the ontogeny of human beings; the rise and fall of plant communities is analogous to the rise and fall of human civilizations; equilibrium in the environment is comparable with equilibrium in the mind; and colonial terminology is useful to explain the development of both human and plant societies. Tansley pushed the analogies so far that he found it necessary to remind the reader of the obvious fact that plants, after all, are not conscious species.[121]

The argument by analogy was based on his psychological epistemology. "The human mind," Tansley explained to his fellow ecologists, "is irresistibly impelled to express this [classification of vegetation] in some systematic form," because the mind indispensably creates "a framework into which to fit our investigation."[122] Curiously, he defended philosophical realism, but ar-

gued that the ecological reality did not exist independently of human experience. The ecological view of the world was a construction of the human mind forced upon nature: "We must never conceal from ourselves that our concepts are creations of the human mind which we impose on the facts of nature."[123] He thus freely draws on concepts from his social psychology to develop his ecological terminology, with numerous analogies between human society and plant communities:

> A human community, like a plant community, consists of separate individuals with independent powers of existence, growth and reproduction. But taken together these individuals make a new whole, a unit of higher order, with its own structure and functions depending on the definite inter-relationships of the individuals composing it. Such a community generally has differentiated classes or groups of individuals within it, each of which may carry out more or less separate functions, corresponding with organs of an individual organism. Some of these may be useless or nearly useless to the community as a whole, others are essential to its existence. The "corporate life" of a highly integrated community represents the life of the higher animal organism, the executive government the central nervous system.[124]

Such analogies are not new in western culture; they go back at least to Plato. What is striking is Tansley's account of the human community where individuals together make a unit of higher order or different classes within human society. He spelled out the theme of how some classes may be "useless or nearly useless to the community as a whole," while "others are essential to the community's existence." Later in this article Tansley explains the structure of plant associations by using terminology from the human community such as nationality, business, interest or opinion, taste, guilds, and even religion, all of which are various ways of organizing plants according to the activity of the human mind forced upon nature.[125]

A few years later, Tansley wrote his first textbook on plant biology, intended primarily for medical students. This book represents a continuation of his mechanistic psychology, now expanded to the mechanism of plants. Given that the audience for the book was medical students, he could freely introduce a whole set of psychological terminology in the field of biology. As in his mechanistic view of the mind, Tansley introduces the ecological idea that "all living organisms may be regarded as machines transforming energy from one form to another." Furthermore, he introduces *"the general physical law that all systems tend towards equilibrium,"* a theory he developed in his psychology.[126] Notice in the following passage how Tansley reformulates the old idea

that ontogeny recapitulates phylogeny into a reductionist argument about the law of equilibrium:

> the great universal *law of equilibrium* . . . governs all the processes of which we have any knowledge, from the movements of the planets to those of molecules, atoms and electrons, from the activity of protoplasm to the vagaries of the human mind. All things which exist are constantly tending towards positions of balance or equilibrium . . . The universe consists of the most varied kinds of systems in relatively stable or unstable equilibrium, and every fresh disturbance of equilibrium from outside any system leads to fresh activity in the system which tends towards the establishment of a new equilibrium.[127]

Although Tansley does not use the word "ecosystem" in this passage, it is probably his first theoretical formulation of the concept in his biological writings, and its explanation in terms of an equilibrium clearly derives from his Freudian psychology of the mind. This indicates that Tansley thought in terms of ecosystems as early as 1922, long before he coined the word in 1935.[128] Tansley was not the only scientist using the law of equilibrium to explain everything from systems of planets and atoms to plants and the human mind. It was a much-discussed topic at Cambridge University at the time, particularly among economists, and he thus followed a general scholarly trend. He may have been inspired by William Lewis's popular textbook about systems in physical chemistry of 1916.[129]

Yet the trend had not arrived in ecology, and Tansley avoided any radical shift of emphasis in his 1923 "guide for beginners" in ecology. The book's purpose was to provide an alternative to Bower's morphological textbook in botany and Frederic Clements's somewhat outdated *Research Methods in Ecology.*[130] The book was written to boost ecology as a discipline at the universities, and to furnish Tansley with a much-needed income after resigning his position at Cambridge.[131] The new textbook introduced a new generation of postwar students to ecological concepts and kept the growing community of ecology scholars together.

Tansley did not offer a psychoanalytic explanation for ecological studies; he did not believe that sea or water could be equated with vagina and uterus or that fish was a hidden symbol for penis.[132] What he did believe was that a complex system like the human mind or society could be explained in terms of simple biological processes, which in turn are based on physical and chemical laws of energy. The transfer of psychological terminology into the realm of botany was based on this assumption.

The British Empire Vegetation Committee

Tansley did not have any university or college position from 1923 until 1927, and thus had to find other ways to secure his and his family's livelihood. In other words, he had to find another patron. There is a corresponding and significant shift in the focus and content of his work in this four-year period, starting with his appointment as acting chairman for the British Empire Vegetation Committee by the Imperial Botanical Conference upon his return from Vienna in 1924. In this work he became closely associated with Thomas Ford Chipp.

It is worth taking a short digression into Chipp's life because he plays an important role in the early history of British imperial ecology as one of Tansley's collaborators. He was the second son of a constable in Gloucester who died in 1891 when Thomas was only five years of age.[133] His education was then left to the Freemasons, because of his father's death and his mother's inability to secure his education. After leaving the Royal Masonic School he became a student gardener at Kew, and later a student of Oliver at University College, London, where he graduated with an honors degree in botany in 1909. He then took a job in the colonial administration as conservator of forests in the Gold Coast. His diaries and notebooks from this period reveal an almost frenetic ecological activity in favor of industrialization and imperial mission for the region.[134] Most telling in this material is the fusion of colonial economy with research on local vegetation. His report on the Permatang Coconut Estate at Jugra Selangor from 1911, for example, included a general description of the estate with such details as its boundaries, topography, climate, production, revenues, and market value, as well as suggestions for future treatment and commercial value of the forest.[135] It is similar to his report for the Rubber Estates in Perk Selangor, which included extensive descriptions of the social condition of the labor force.[136] These reports were not published in scientific journals, but only read by local landowners. Thus, they did not make a contribution to scientific ecology but do reveal the social aim and technical background of Chipp's later research, in which he blended economy and ecology and considered the civilizing role of scientific research. More important, Chipp's practice of collecting and organizing evidence is identical in early administrative reports and later ecological research. In the Gold Coast he created a whole series of forms and questionnaires related to forestry that he distributed to a large network of landowners.[137] These included questions related to forest management, from growth of trees to criminal offenses by woodcutters.[138] He used evidence from these inquiries in his later ecological writings. There is thus a clear influence from colonial administration in his scientific writings and means of organizing knowledge.

With Tansley, Chipp became one of the prime organizers of ecological research in the early twentieth century.

During the war Chipp served as captain and later major in the British Expeditionary Force, 56th Division, in France. This was a military unit involved in heavy fighting, an experience that "told greatly on him" for the rest of his short life.[139] After the war he returned to the Gold Coast, where he continued to work on forest management. This eventually resulted in a dissertation on the ecology of these forests, which later appeared as a book, and a doctoral degree from University College, London.[140]

From 1922 Chipp worked as assistant director of the Royal Botanical Garden, Kew. His lecture notes from this period are preserved, and reveal a keen interest in environmental history and ecological organization. When he guided his visitors around the garden he emphasized the social history of plants as examples of successful colonization. The distribution of coconut, oil palm, and banana, for example, was due to exultant human plantation all over the tropical world dating back to the seventeenth century.[141] He thus took the historical transformation of the literal face of the Earth by human beings as a yardstick for judging achievements of the British imperial mission. The legitimization of imperialism was for him readable in the ecological history of a colony, and the Kew Gardens thus served as the very image of the empire's commercial achievements.[142] The ecological relations among the plants in the garden were a sub-language for relations among colonies. In the midst of this garden, Chipp points out, one finds the "Director of Kew [who is like] a spider in the centre of his web . . . [He has] to keep in intimate touch with all the threads of the work in progress in each of the separate departments and with all the important matters raised by correspondents at home, and abroad."[143] Chipp was the spider's assistant, and during his time at Kew he managed to create a true web of networks among up-and-coming ecologists as secretary for the British Empire Vegetation Committee, the Imperial Botanical Conference, and for the fifth International Botanical Congress. By using his experience as a major in the army and his strong ties to the Freemasons, he cleverly organized the science of ecology. His work as a secretary and supporter of ecological science was done in the Freemason spirit of loyalty, hierarchy, and secret brotherhood.

The history of the Imperial Botanical Conference can be traced within the history of the International Botanical Congress, which met every fifth year. Paris had the congress in 1900, Vienna in 1905, Brussels in 1910, and London was supposed to have it in 1915, but this was delayed because of the war. After the war the Association Internationale des Botanistes was "so seriously affected by the blessings of peace that its own continued existence had become precarious," and it was not able to bring together botanists from con-

flicting countries in an international gathering.[144] Consequently, the British organizing committee decided to prepare for an imperial instead of international conference in 1920, but the meeting was deferred until 1924 so it could be arranged at the same time as the grand British Empire Exhibition. This was a marketing issue for the host of the conference, the Department of Botany at the Imperial College of Science and Technology at South Kensington. London was crowded during the Empire Exhibition with potential patrons from the colonial administration, and the Department of Botany did not miss the opportunity to make a special exhibition in their rooms intended for movers and shakers in various colonial government agencies. At the Wembley fair colonies and protectorates had pavilions surrounded by artificially built environments meant to look like their respective economies of nature; including environmental guidebooks about climate, geography, vegetation, animals, and the human population, which in their structure and content resembled ecological surveys.[145]

The search for patrons dictated the content of the conference, which was organized around the economic, practical and educational value of botany. This served as a starting point for discussions on how to develop scientific methods that could serve such social ends. These debates were centered around genetic approaches (with William Bateson as the main collaborator), ecological approaches (with Tansley and Chipp as the main contributors), or a blend of both. The lectures on genetic approaches focused on economic possibilities concerning the breeding and improvement of apples, sugar-cane, coconuts, rubber trees, and other kinds of crop plants and forests. They were followed by ecologists, who lectured on the best means of promoting a complete survey of plant communities in the empire. A complete botanical survey of the empire was to include both a full-scale genetic map of all the resources in the colonies and an ecological survey of relations among the species. In the division of labor the genetic approach focused on the development of individual species, while ecologists concentrated on overviews and relations between them. The focus of this grand survey was the economic aspect of botany; as one lecturer put, "it is our duty as botanists to enlighten the world of commerce."[146]

Much of the conference was devoted to spelling out what was already done or ought to be done in various colonies to realize the grand botanical survey of the entire empire. Most delegates agreed that current and past botanical research was fragmented and that future research should be organized within the scientific context of a survey, which would be of value for further growth of the empire. The delegate from India, for example, confessed that past botanical research in this colony was sketchy and that it should not be a model

for the future, and similar views were expressed by Tansley and Chipp in their summary of research in Burma, New Zealand, and Canada.[147]

The only botanical survey in the colonies that the delegates could look at as a model for their survey of the empire was that of the Union of South Africa. The next chapter will explore in detail the extraordinary context of this survey. What is noteworthy at this point is that Illtyd Buller Pole Evans, the director of the Botanical Survey of South Africa, could proudly present a six-year-old survey with an established body of organized botanists on his team, and the famous politicians General Botha and General Smuts as the survey's patrons.[148] John William Bews, a prominent South African ecologist, argued that South Africa had the best habitats for ecological research, partly because they were uncontaminated. With a subtle reference to Oliver's research on urban fog he said that it was a poor solution for the progress of botany to be practiced "in large industrial cities where the chief 'limiting factor' is the amount of coal-dust in the atmosphere."[149] In other words, he was questioning the possibility of learning how to carry out ecological surveys in polluted cities like London or carrying out research in tainted habitats. Such rivalry was not, however, the general tone of the debate, and the British ecologists were clearly taken aback by the South Africans.

Indeed, the South African presentation was a minor shock to established British ecologists, who realized that they could not take for granted that they were the leading ecologists of the empire. At the close of the conference Tansley and Chipp thus secured a series of resolutions designed to place Britain at the center of the grand survey. The British Empire Vegetation Committee with London ecologists was appointed to organize and thus control the Botanical Survey of the British Empire.[150] Their task was to provide an overview of existing botanical and ecological knowledge as well as to promote further research. The means of doing this was to prepare a series of monographs on vegetation in the empire, to register and make abstracts of all published material, and finally to create a handbook on aims and methods for use by ecological workers on the grand survey.

Using Nature's Method for Imperial Management

To promote ecological research in the tropical colonies and protectorates the British Empire Vegetation Committee published in 1926 a handbook, *Aims and Methods in the Study of Vegetation,* edited by Tansley and Chipp.[151] The monograph, which was well received by ecologists, outlines a method for exploration and aims for exploitation. British ecologists had long been involved in colonial research; Tansley, for example, had made such a research journey

to Ceylon and the Malay peninsula as part of his research project as a student of ecology. Such research was compatible with Fabian socialism, giving an overview of the assets and stocks of natural vegetation in the British Empire that had economic value and suggesting how this information could serve its people.[152] The book itself was also meant to be an asset for the committee.[153]

Aims and Methods consists of a general outline of ecological methods written by the committee and regional studies on how this method had been applied in different parts of the empire. The monograph thus offers an example of both theoretical and practical ecology as Tansley and his colleagues saw it in the 1920s.

"It is hardly possible," the committee explains in the preface, "to conceive a property owner or stores manager carrying on the management of a large estate or general store and yet being unaware of the stock at his disposal, the extent of his supplies or their nature."[154] The image here is of Britain as the property owner and manager of the colonies who unfortunately is unaware of the natural supplies at their disposal. To obtain such knowledge the Protectorates needed ecologists who could map out "the vegetational assets" available to the Crown. Good management of a colony can only be obtained if the empire's economy adjusts properly to the economy of nature. The ecologist could, with "native labor at his disposal,"[155] explore and chart the local vegetation for the colonial administrative institutions. The basic idea was that natural vegetation cannot be utilized for human purposes without the guidance of social responsible science.

The terminology that describes plants and vegetation resembles colonial language. Plants "establish themselves on soil 'prepared' for them," higher forms of plants "kill out the lowly pioneers," and establish new plant "associations," "kingdoms," "societies," "clans," and "colonies," and certain species "dominate" these "communities."[156] This terminology was appealing to the colonial administration; the resonance among codes of political, economic, and scientific systems could create a colonial power cluster.[157] The metaphors used in descriptions of plants created a stream of normative political and economic associations. Tansley did not try to avoid such ecological trespassing into other social domains because he believed that biology was the foundation for the human mind and hence also for the social realm.

After the introduction on ecological methods, the committee explained that the ideal student should have training in biology, climatology, geography, geology, surveying, agriculture and forestry, and last, but not least, detailed knowledge of the economic uses of plants. When this skillful student arrives in the colony, he or she should first become acquainted with the land through reconnaissance with the help of the compass. The next step is to draw a map of the area, preferably with the help of air photography, and fill it

with relevant biological and economic information, such as "*m* = mangrove fringing forest" or "*k* = Kanazo forest."[158] Maps are territories that define our place in the world and lay down the criteria for what is to count as relevant knowledge.[159] Relevant ecological knowledge in British territories was information that could be of help in the management of the colonial estate. After first making the overview map, which represents a detachment from the reality of the environment, the student of ecology should draw profile charts of the soil with its root systems.[160] With both a horizontal and vertical map in place, the student was finally prepared to collect, organize, and preserve specimens from the habitat.

The environment could explain why certain plants grow in certain kinds of places and not in others, yet the editors did not accept the old Hippocratic theory that human conduct is determined by airs, waters, and places. Instead they defended what today is known as environmental possibilism: the habitat has a series of possibilities that affect human development, and the way development takes place is dependent on the people concerned: "Man, then, is *the* great biotic factor working on vegetation," the authors point out, and "[c]ivilised man, of course, destroys natural vegetation altogether on an extensive scale, and replaces it by buildings or by planted crops."[161] The modification of the habitat by animals is determined, but for humans who have a *telos* and direction in their psychic energy, the environment represents a whole range of stimuli to which humans could respond in a variety of ways.

The Vegetation Committee ran into a methodological problem about how "to decide how 'membership of the [ecological] community' is to be limited and what factors can properly be called 'external.'"[162] They point out that a plant community, like a forest, which after ages of succession has reached a stage of ecological equilibrium or climax, might be disturbed and ultimately destroyed by external biotic factors, such as change in climate, colonizing earthworms or crowds of birds, parasitic fungi, large herds of browsing mammals, and effects of human activity. The problem of how such factors should be understood relates not only to the problem of fixing a border of an ecological habitat (for example whether or not crowds of birds are invading an environment), but also to the understanding of biological and historical development of a territory. The problem was not only to draw the line between different ecological communities, but also to distinguish between friendly and hostile relations between them:

> How are we to draw the line between those which act as *members* of the community and those which are to be considered external—whether "hostile" or "friendly"—to it? Some ecologists have tried to get over the difficulty by considering *all* the organisms, animals and plants together,

> living in one place and mutually acting upon another, as members of the community, as a biotic unit. There is a good deal to be said for this conception from a philosophical point of view, for it is really the whole of the living organisms together, *plus* the inorganic factors working upon them, which make up, in a climax community, a "system" in more or less a stable equilibrium. But such a "system" considered fundamentally, that is, physically, must include the "inorganic" factors of the habitat and these obviously cannot be considered as "members" of the community; and if we take the inorganic factors as external, why not biotic factors such as grazing animals?[163]

The notion of a fundamental physical system is introduced to include both friendly, hostile, and inorganic factors of the habitat. The amount of matter and energy being constant, ecological factors must add up to balanced cycles of matter and energy. The idea of such cycles, in combination with thermodynamics, was an essential component of Tansley's system of the human mind and of ecology.

In the passage quoted above, the authors refer to Ernst Haeckel, who emphasized the "hostile" relations between species within or outside a plant community.[164] The first sentence in this passage is in fact a critical question that paraphrases his 1866 definition of ecology.[165] The more gentle Chicago school of ecology, emphasized instead the "friendly" and cooperative relations among species. The solution for the British ecologists, on the other hand, was to reduce ecological relations between species, whether they were friendly or not, to a system of exchange of energy.[166]

Human agency greatly influenced plant communities, and the role of ecologists was to make sure this was done in the interest of the British Crown. This is particularly clear in the practical sections of the monograph, in which different authors explore the history and practice of ecology in the dominions. The driving force in imperial ecology was economic opportunities hidden in the utility of various plants. One author, for example, points out that tropical fungi can be of great importance in developing medicine for various diseases, and that this topic is a practically untouched field in the empire.[167] Another contributor emphasized that ecologists know little about seaweed, and that this "is only to be expected since . . . [seaweed] are of little economic importance, [. . . and the algologist] cannot claim that an algae survey of the British Empire is of such vital importance."[168] Knowledge of the economy of nature was relevant only if it was of importance to the economy of the British motherland.

Chipp's own contribution to the volume is of particular importance in understanding colonial ecological research. One problem in the Gold Coast, according to Chipp, was that the natives caused "widespread destruction of the natural vegetation [. . . of] considerable local economic importance," because of "dense population," "movement of tribes," and "political insecurity."[169] Environmental problems in the area were allegedly caused by aborigines, and it was up to the British colonial administration to tidy up these problems with the help of an ecological survey: "As soon as the natives begin to farm in the forest the equilibrium is destroyed," Chipp explains, because of their "evil" habit of clearing "virgin forest" with the help of fire.[170] However, if the colonial administration resists the local traditions of burning forests and stops the movements of tribes, then good economic prospects may arise, especially with regard to exploitation of mahogany. Moreover, natives are ecologically ignorant, and the field ecologist must thus "not rely on a native fetching him specimens, or showing him plants."[171] Chipp's scientific approach to colonial forest management is typical of most of the contributors to the monograph. What was significant about the natives was their bad habit of forest clearance by means of fire, and often their high birthrate.

None of the ecologists offered empirical evidence of the lost forest equilibrium; they simply assumed that the landscape was covered with forest before historical time. This was a reasonable assumption and for some a self-evident fact from the point of view of Clementsian climax theory; an assumption that only recently has been seriously challenged.[172] With the dogma of the lost forest, ecologists could offer a legitimization of British imperialism; they could argue that the empire was saving the native tribes from themselves and their bad habits of forest clearance.

The aims and methods of colonial ecology did not involve any applied science derived from pure ecology. Ecology was rather an entangled bank of economy, colonial management, and systems of vegetation classification. Some authors preferred not to distinguish between economy and ecology and used instead the term "economic ecology," because for them the economic aim of colonial management simply coincided with ecological method, hence the title *Aims and Methods in the Study of Vegetation*.[173] The aim of colonial economy was for the ecologist to recapitulate the economy of nature. They also saw the economy of semi-nature (nature affected by the human factor) as the product of a historical recapitulation of a colonial economy. To quote one example of this "ecological-economic" mix:

> In order to understand how to make economic use of any vegetation without bringing about its destruction it is necessary to find out as much as possible of its ecology and life-history. Ecology is often taught as a part of silviculture, but the latter is really its practical application. Nature works in a certain manner, and the clue to the exploitation of economic

> plant-communities lies in using Nature's methods in such a way as to turn them to the service of man in the directions he may desire.[174]

Economic use of a species was to be coordinated with its ecology to avoid its destruction. In other words; a responsible economy had to rely on nature's own methods.

The next step after *Aims and Methods* for the British Empire Vegetation Committee was to issue a survey with abstracts of research on vegetation in the colonies. Chipp, the editor of the index, created a system of knowledge that set him and the Botanical Garden at Kew in the center of the web of ecologists. The committee invited all the subscribers of the *Journal of Ecology* to submit abstracts and lists of their publications relevant to the grand botanical survey of the empire. These abstracts would appear in the index as edited by Chipp, who exercised his editorial prerogative to shorten all irrelevant abstracts and lengthen relevant submissions until the survey of botanical science had become a survey of ecological science. The result was a 200-page index with no less than 822 entries published as supplements to the *Journal of Ecology*.[175] In this impressive list only articles with an ecological approach had comprehensive abstracts, while botanical works in the tradition of natural history appear with merely a short reference. The Freemason editor, with the committee's approved policy of inclusion and exclusion, thus helped to establish a sense of community, a brotherhood, among ecologists spread around in the empire.

Two different research approaches in ecology emerged in Britain at the turn of the century; one conservative and morphological in Edinburgh and another more radical and plant geographic among Londoners at the University College. Tansley belonged to the latter group, who sought to construct botanical research methods that would be useful for society. This group suffered a defeat to the morphologists, and Tansley would abandon ecology for some time, turning to Freudian psychology for personal and academic renewal. When he came back from Vienna, he reconsidered ecological concepts in psychological terms, while at the same time searching for patronage for ecology in colonial agencies through the British Empire Vegetation Committee. This patronage would prove to be crucial for ecologists, especially at Oxford University, where Tansley was finally offered the Sherardian professorship in 1927.

Before returning to these events, it is necessary to step back and explore in depth ecological research in South Africa at the time of Tansley's writings. The next chapter seeks to unveil the political context of the Botanical Survey of South Africa, where students of Tansley's archenemy Balfour would find a major scientific patronage.

2

General Smuts's Politics of Holism and Patronage of Ecology

Parallel to Arthur Tansley's project of socially concerned research was a more idealistic and spiritual strain of ecological reasoning launched by the South African botanist, general, and politician Jan Christian Smuts. Although they had different political and philosophical agendas, Tansley and Smuts both tried to ground the science of ecology in human psychology, or *personology*, as Smuts called it. In this chapter I will explore how Smuts used ideas of environmental holism and of the evolution of the mind to draw up a comprehensive political and scientific program for ecological research in South Africa.

Smuts was known throughout his life as a vigorous defender of human rights and of the League of Nations; indeed, he wrote the first draft of the United Nations' preamble on human rights in 1945. Yet he was also known for stern oppression of black South Africans, labor unions, and political revolutionaries; he is also remembered as the general who jailed Mahatma Gandhi. This apparent contradiction provides a focus for my analysis: How could someone both defend human rights and carry out a policy of racial segregation and political oppression? There is no simple answer to this paradox, and my attempt to address it cannot be seen as a full explanation. Yet Smuts's patronage of ecology is an illuminating example: what may look like a paradox to our contemporary eyes actually was a coherent ecologically oriented politics of holism.

In what follows Smuts's passion for nature and his training as a lawyer serve as contextual explanations of his reading of natural law as a basis for civil law. These readings of law were recapitulated by 1926 in a grand theory of holism and evolution. In his moral and political thinking Smuts also became known as a defender of *graduallism*, by which he meant that people should gain civil rights and respect incrementally in accord with the stage of their evolutionary development. Smuts would use these successive stages in the development of the human mind in his holistic theory of the successive steps of evolutionary development in general. In this chapter I will discuss how the leading ecologists in South Africa such as John William Bews and John Phillips owe a great debt to Smuts and his politics of holism. I will consider