Governing Antarctic Bioprospecting: From static containment to active management

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Scientists have recently been exploring life at a more elemental level than ever in order to address increasingly nuanced questions of human health and economic growth. By modifying the processes of life at the genetic and molecular levels through the use of biotechnology, they can find solutions to genetic diseases or provide an organism with the capacity to grow other compounds for human use. Investment in this new technology has been based on the idea that large amounts of money can be derived from applications of novel biological knowledge. One of the components of this industry is bioprospecting. Bioprospecting describes the scientific exploration of biologically diverse organisms to find commercially applicable genes or biochemical processes (Reid 1994). These genes or biochemical processes may then be extracted and altered in such a way as to produce a novel property. In order to derive a profit from this activity, a number of global intellectual property rights have been negotiated to regulate the trade in biotechnology. The industry has thus approached biology in an instrumental way such that biological processes and matter may be separated from their natural origins and modified in such a way to become individually patentable pieces of property (Thacker 2005). An understanding of the current trade in biotechnology (and the utility of biodiversity within it) therefore rests on an understanding of property rights.

There are many different definitions of and ways to approach property. Property is generally referred to as a system of rules that regulates access to and control of material resources (Waldron 1988). This claim to a particular resource is enforced against other claims (Macpherson 1978). Above all, property is a social relation between people through objects of property (Demsetz 1967). In this way it parallels the practice of

territoriality, which uses control over space as a strategy to control people and objects. The most dominant property system, and the one to which most people are colloquially referring when discussing "property," is the private ownership model, which assumes a unitary owner of an object of property separated from others by boundaries which delineate at which point non-owners may be excluded (Blomley 2004). Dominant liberal ideals are built around a model of private ownership in which the role of the state is to enforce private property rights (Marzulla 2001; İslamoğlu 2004). A great deal of literature on property rights has assumed the ubiquity of this property model.

The predominance of the private ownership model has often obscured the existence of other models of property, which include community and state-managed property systems. Local community ownership allows public access predicated upon continued and active use of the item. In principle, the resource is available to all members of the community equally (Waldron 1988). Within the model of state ownership, the property item is held in trust for all citizens by the state. The state may grant or deny access to the property item based upon its own rules and regulations (Demsetz 1967). Disputes over property use within this model are usually settled according to what benefits the collective interest most (Waldron 1988). Both of these models assume a collective interest to be met.

In addition to the variety in the types of existing property systems, it has also been pointed out that different subjects have property rights associated with them in differing ways. Water (Bakker 2003), seeds (Kloppenburg 1988), and land (Blomley 2004) are just a few of the many items that have had differing property rights associated with them as a result of their particular properties. Bioprospecting generally involves the development of

intellectual property rights, which also have unique characteristics. For example, whereas in most cases property rights are designed to address scarcity, intellectual knowledge is a resource that becomes *scarcer* through the creation of private property rights. Through the process of patenting an idea, making the implementation of the knowledge contained therein an exclusive product, intellectual property takes knowledge out of the community and makes it unavailable except when permission has been granted to use it. The potential for intellectual property in bioprospecting comes not simply from discovery of new organisms or extraction and processing of their "useful" traits, because the products of nature cannot be patented. Instead, a scientist must subsequently alter the organism or process from its natural state and invent something based upon it (Strathern 2001). While it might be argued that the biochemical processes and methods patented under the rubric of bioprospecting do not qualify as material resources, these concepts and processes must be materially enacted for them to be useful and patented (Strathern 2001). For example, to use glycoproteins retrieved from Antarctic fish for making a freezable tomato, material processes must be enacted according to the instructions of the process. In this way, intellectual property takes a material form and shape.

These intellectual property rights are subject to similar liberal assumptions as other resources. The liberal model of property has influenced the ideals of free-market environmentalism (Anderson and Leal 2001). In this view, community ownership is attacked as inefficient and dangerous, as suggested in the "tragedy of the commons" argument (Hardin 1968; Demsetz 1967). The difference is that since intellectual property is not typically considered a finite resource, the tragedy is not of the commons being overutilized, but of innovation not being stimulated enough. According to liberal theory,

rational economic humans have no incentive to innovate if their discoveries are not rewarded with the protections given by property rights (Drahos 1999). This questions the fundamental motivations of scientists and assumes that without private property protections in place, Antarctic scientists who would otherwise be involved in bioprospecting have no reason to work.

There have been a number of recent critiques of this property system's outcomes. Within the private ownership system the possession of property frequently rests on its dispossession from somebody else, perpetuating inequality (Blomley 2004; Harvey 2003). The withdrawal of knowledge from the public sphere through the implementation of intellectual property rights has been critiqued as eliminating the ability of developing countries to reap the benefits of "freeriding" on the innovations of more developed countries, which those developed countries might have exploited earlier (Drahos 2002a). The increase in private property and the decrease in public property (whether state or community) also has the effect of allowing structures of domination to continue (Landes 1998). In specific reference to the work of bioprospecting, Vandana Shiva uses the term "biopiracy" to refer to the displacement of indigenous knowledge of and access to their biological resources by the monopoly rights of others working within the private ownership structure of rights (Shiva 1997). It has also been argued that private ownership should not necessarily be automatically equated with freedom, and that there are other ways to gain political control (Strathern et al. 1998). Recent literature has also encouraged readers to become aware of alternative ideas of property, such as a generalized "native model" of property in which rights are inalienable (Blomley 2004). In

these ways, the dominance of the private ownership model of property has been challenged.

The structural weaknesses of the ownership model can be examined through the situation of potential intellectual property rights that might oversee biological prospecting in Antarctica. Rather than critiquing the outcomes of the private ownership model, I critique some of the fundamental assumptions of this model by showing how they fail to encapsulate the issues brought up by Antarctic bioprospecting. There are three main assumptions that previous regimes related to trade and biodiversity have taken for granted when dealing with intellectual property rights. The first is that the world is divided into discrete packages of territory that are each overseen by a sovereign state. Therefore the state becomes the instrument of enforcement of patent law and simultaneously a steward of the biodiversity within its borders. The second assumption is that these biological resources are only accessible through local rather than global resources. Somehow, the biological resources that are dealt with under most conventions are not recognized as potentially migratory or available through global databases. Third, in order for any regime of intellectual property rights to exist, the boundary between nature and society must be discernable. In order to hold an effective patent over a biochemical process or gene, a scientist must alter it from its "natural" state. These three assumptions posit a containment of power and resources within states and a clear separation of the concepts of nature and society. Altogether, these assumptions understand the components of bioprospecting governance as things that can be separated and contained through static regimes or contracts. In response to this, I propose a new governance model for Antarctic

biological resources which stresses active and hybrid management rather than a static treaty based on ideas that clearly do not apply to the area.

Assumption #1: State territoriality as a given in bioprospecting regimes

Bioprospecting regimes have been traditionally built on the concept of the state as the focus of power and authority. States are assumed to have complete knowledge and control about what goes on within their borders, and to control the goods that flow across those borders. Although at differing stages of development, states around the world are converging on similar IPR standards (Drahos 2002a). Much of the effort to study international IPR regimes has therefore focused on states as the loci of legitimate authority. This conception is reinforced by having the signatory members of bioprospecting agreements be states and relying on them to enforce agreements largely through control over what passes between their borders and activities which are contained within their borders. These measures fail to take into account that power has been conceptualized recently as flowing more through bodies than through borders as well as the growth in the number and strength of other global power-brokers. These new political realities are well-illustrated by the conditions in Antarctica. But before addressing the challenge of Antarctica and its biopolitics, I will first discuss how states and borders are crucial to bioprospecting regimes.

First of all, states are the signatories of international conventions addressing bioprospecting. Important international governance agreements for IPR and bioprospecting in particular include the Convention on Biological Diversity (CBD) and

the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement. Both of these are international agreements negotiated and signed by states. The CBD was a product of an United Nations convention held in Rio de Janeiro, Brazil in 1992. The document that emerged from that meeting went into force in 1993. In it, the member nations put forth their concern for the protection of biodiversity and sustainable use of natural resources. A key policy element of the CBD, stated in Article 19 of the Convention, is the promise to attempt fair and equitable sharing of biotechnology benefits between contracting parties that conduct research on particular genetic resources and contracting parties that provide those genetic resources from within their jurisdiction (Convention 1992). Article 35 leaves the CBD open to accession by states and "regional economic integration organizations", but the organizations are only allowed to vote "in matters within their competence" according to Article 31 (Convention 1992). Even when they are allowed to vote, Article 31 measures their power (as expressed in number of votes) in terms of how many states are members of their organization (Convention 1992). Subsequent to the formation of the CBD, representatives from the states involved have held conferences to elucidate more specific procedures to follow. One outcome of these meetings has been the *Bonn Guidelines on the Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising Out of Their Utilization*, which are non-binding suggestions as to how to go about negotiating access and benefit-sharing agreements. The TRIPS agreement was made in 1994 during the Uruguay round of the General Agreement on Tariffs and Trade (GATT). The states present for the negotiation pledges to provide patent protection in all fields of technology, allowing for greater internationalization of the research and development industry. The treaty is administered by the World Trade

Organization (WTO). The TRIPS preamble explicitly establishes that the intellectual property rights being negotiated are considered private rights. Member states are supposed to apply the principles of TRIPS to all of its nationals (people living in their territories or who have businesses based out of them) as defined in Article 1 (Agreement 1995). The application of TRIPS is therefore territorially based in state sovereignty.

In addition to promoting the idea that states are the dominant and most legitimate sources of power by making them the only members of the negotiated agreements above, these international treaties also reinforces the idea that the key to state power is the regulation of border flows between states and complete sovereignty over the people and institutions housed within their borders. Each agreement assumes that states have the power to make their citizens/ industries comply with the national will as expressed in these treaties. The method of making nationals comply is largely left up to each individual government, except in the case where a national is negatively impacting another country. Article 3 of the CBD explicitly states that states have the sovereign right to exploit their own resources to the degree that this exploitation does not generate environmental damage beyond their borders (Convention 1992). Article 1 of the TRIPS agreement acknowledges that member states may implement more extensive IPR protections as long as they do not go against the basic principles of TRIPS. Enforcement within TRIPS is seen as the responsibility of host states as declared in article 41 (Agreement 1995). Therefore the CBD emphasizes sovereign rights as long as they do not impact the environment of other states and TRIPS recognizes the sovereign rights of its states as long as they do not impinge upon agreed-upon principles of intellectual property trade between states. The resolution of disputes between states over

interpretation of each treaty are addressed by mechanisms within both the CBD and TRIPS. The regulation of intellectual property across borders is addressed in different ways in each agreement. Articles 15 through 19 of the CBD establish the terms of interaction between states when one state utilizes another state's biological resources (Convention 1992). Access to biological resources should only take place with a mutual agreement in place between the states involved in the transfer of those resources. This also assumes that states have control over access to their biological resources, but I will address that point soon. The point here is that access is granted by allowing the resource or information regarding it to cross the borders of the country, therefore control over this is assumed to take place at whichever border the resource must cross to get outside of its native country. Similarly, Articles 51 to 60 of the TRIPS agreement call for governments to regulate the trade in intellectual property through customs stations at their borders (Agreement 1995). These actions may be as simple as allowing for suspect goods to be inspected or as serious as pulling illegal intellectual property from circulation. The sites that these actions are supposed to take place are at customs stations, which are usually found at the territorial borders of each state. The state therefore acts as a container of power, and violations must be dealt with before they are able to physically enter other territories.

The legitimation of state power to the near-exclusion of other political interests as well as the reliance on the states perceived territorial sovereignty as a container of power are both concepts which have been challenged by recent political studies. The concentration on state power and the marginalization of other organizations ignores the fact that more non-state actors have become involved in issues of global environmental

governance. Non-state actors may include environmental non-governmental organizations (NGOs), industry interests, scientific experts, and other groups generally associated with civil society. Paul Wapner has been pointed out that indicates that while states might have power in the form of legitimated violence and regulation, NGOs have a larger impact in shaping human behavior and therefore have political power (Wapner 1996). There are examples of non-state actors impacting the global warming debate (Newell 2000; Betsill and Corell 2001) and the regulation of whaling (Skodvin and Andresen 2003). More non-state actors are also participating in the construction of agreements within the field of bioprospecting, particularly in the developing world where resources to address inequities is harder to come by (Drahos 2002b). Transnational advocacy networks have partnered with developing countries to help ensure that they are adequately compensated for the use of their resources. Companies within the biotechnology industry are also having their presences felt as the IPRs which have been established have had the effect of consolidating a great deal of their power. Their interests are more often met than the public interests in these arenas if Mancur Olson's theory regarding representation imbalance is to be believed (Drahos 2002b; Olson 1965). To assume that all states can fairly balance all the interest groups which deal with them outside of international negotiations assumes a great deal, especially given the varying bargaining power of states at different stages of development.

If power can be attained and used by non-state and often non-territorial organizations, it stands to reason that concentrating authority in border power may be insufficient. Recent scholarship points to a shift from power irrigated through national borders to power that flows through human bodies. Michael Hardt and Antonio Negri

declare that “Power is now exercised through machines that directly organize the brains (in communication systems, information networks, etc.) and bodies (in welfare systems, monitored activities, etc.)” (Hardt and Negri 2000). This is the concept first put forward by Michel Foucault as biopolitics (Foucault 1979). Here, people are seen as smaller living components of a larger organism which directs them to governs themselves. If we consider the state to be the larger organism, each individual is directed by governmentality to serve the interests of the state. Hardt and Negri explore the possibility of sovereignty beyond the state, in the form of a global overarching network sovereignty which protects the interests of the powerful which they call “Empire” (Hardt and Negri 2000). The state exists as one of the institutions through which this power is expressed, but it is by no means the only one. Economic processes, particularly those connected to the surge in globalization, also have an influence. Biopolitics has been incorporated into studies of the biotechnology industry, as the automatic labor of biological processes has been appropriated by businesses to produce for them (Thacker 2005). The fact that life itself can be controlled and appropriated to produce for the interests which can afford to purchase such rights grants those interests a power which does not acknowledge borders because it may be mobile. The mobility of the power may come from the fact that the organisms they control can move across borders or in the fact that immaterial information is harder to contain within a territory.

These challenges are formally inscribed upon the governance of Antarctica. Antarctica is governed by the Antarctic Treaty System (ATS), established in 1959 with the signing of the international Antarctic Treaty in Washington, D.C. This Treaty established Antarctica as an international space where certain activities are encouraged

(scientific) and discouraged (military, nuclear), but there are no restrictions as to who may access the continent. NGOs are allowed to sit as observers at ATS meetings, and have been known to influence the formation of Antarctic policy (Clark 1994). Scientists, often represented by the Scientific Committee for Antarctic Research (SCAR), have directed a number of agreements which have been amended to the Antarctic Treaty. The tourist industry in the region has formed its own organization known as the International Association of Antarctic Tour Operators (IAATO), which has been self-regulated the industry rather than wait for the member states of the ATS to come up with their own regulatory structure. While seven countries had made territorial claims to sections of the continent (three of which overlap each other on the Antarctic Peninsula), Article 4 of the Treaty uniquely does not prioritize or acknowledge any territorial claims to the area it encompasses, allowing both claimant and non-claimant countries to co-inhabit the same space (Treaty 1959). Currently, there are 46 members of the ATS (28 of which are consultative parties which have voting rights because of their recognized scientific programs in the region). No one territorial claim or non-claim is privileged above others. Borders may exist within Antarctica in the mind of some parties, but these are not universally acknowledged. In addition all stations are subject to the inspection of other contracting parties of the treaty, according to Article 7 of the Antarctic Treaty, therefore borders have no effective stopping power (Treaty 1959). Manzoni and Pagnini claim that the construction of Antarctic territory is exclusively symbolic (the function of territorial actions are more representative than transformative), and therefore label the area a metaterritory (Manzoni and Pagnini 1996). The countries which send people to the continent exercise control directly over those individuals according to Article 8, which

states that each country is responsible for the governance of its citizens no matter where they are on the continent (Treaty 1959). This element of biopower already exists on the continent, standing in for power which would ordinarily be directed through borders. The National Science Foundation (NSF) of the United States extends this idea by indoctrinating the people it sends to the continent with codes of conduct which when violated result in the removal of the offending body from the continent. The threat of being exiled from Antarctica was presented to me as the ultimate penalty when I worked there.

Antarctica is therefore a place where states are no longer the central sources of power, and power is expressed more through biopolitical processes than through the exercise of border rights. Therefore, bioprospecting regimes which rely on states as containers of power cannot account for the political situation of Antarctica adequately. If they were, it would be a threat to the structure of the ATS as issues of national sovereignty over particular areas would be raised again (Hemmings 2005). I should note here that I do not intend to denigrate the political role of the state entirely, but to acknowledge that there are other sources of political power. There is no reason why a bioprospecting regime for Antarctica would have to be directed solely through member state authority. The involvement of other interests and regulation which is attached to individual bodies and not borders could be incorporated into any regime that arises. These are also not necessarily impediments to the containment of resources, but the containment of Antarctic biological resources is challenged by other factors which are present in Antarctica and I will address in the next section.

Assumption #2: Localization of resources

Now that I have deconstructed some of the assumptions surrounding the composition and exercise of power in bioprospecting agreements, I would like to address the assumption that biological resources are isolated to particular locales and can therefore be controlled through the limitation of access to those locations. The CBD in particular depends on resources which can be identified as originating from a particular geographic location (preferably from within a state's territorial boundaries). However, this idea of discrete and controllable biological resources is being eroded by the process of globalization and the increasing ability to access information from just about anywhere. Antarctic biota have already been caught up in this global network of information and therefore controlling their use through controlling access to the continent seems impractical since the resources are no longer strictly contained to that locality.

The CBD depends on biological resources having a nationally identifiable source in order for its principles to work. Article 4 of the CBD limits the jurisdictional scope of regulating biological diversity to the territory it has national jurisdiction over (Convention 1992). The country responsible is then in charge of maintaining the biodiversity of the locale while at the same time accommodating researchers who wish to exploit it in whatever way they wish. In order to accomplish this, Article 7 mandates the identification and monitoring of the biological resources that the state claims (Convention 1992). This has the dual effect of helping conservationists determine what exactly they are trying to conserve and also allows the state to claim the organism as a potential biological resources that they can exploit. This aspect has also been criticized because in

order to create this catalog of biological resources, states must invest money into such a project and this may cost resources that developing states can ill afford (Sampath 2005). Article 15 recognizes the right of sovereign states to exploit genetic resources the same as they would other natural resources and determine access to others who might exploit it as they see fit, although the aim of fair and equitable sharing of resources is a stated goal (Convention 1992). Padmashree Gehl Sampath argues that the investment called for in Article 7 may be worth it if it there are benefits to be received through Article 15 that can offset any undesirable environmental impacts that arise from bioprospecting (Sampath 2005). The CBD therefore recognizes that the state has both the authority and the ability to control access to its biological resources. The TRIPS agreement does not focus on this ability to control local intellectual property. Instead it assumes a right of access to patented information be negotiated with the private owner of the intellectual property, except in specific circumstances of national emergency or greater public good as detailed in TRIPS Articles 27 to 34 (Agreement 1995). As stated before, TRIPS is largely a promoter of private property rights and looks to minimize state interference while maximizing the protections to IPRs offered by member states. While states do not regulate access to patentable materials in this agreement, the right to access them is scaled down to the individual who owns the rights to the invention.

Whereas the first assumption had to do with the authority and power to create and enforce bioprospecting arrangements, the ability to control this resource has to do with (to paraphrase Karen Bakker) how cooperative a commodity biological resources can be (Bakker 2003). In order for a particular subject to function well in private ownership system of ownership it must be commoditized, turned into an ownable and tradeable

object which can be alienated from one context and placed into another. It has been the project of the biotechnology industry to approach life in an instrumental way in which a gene or natural process may be extracted from its natural context and placed into an artificial one (Thacker 2005). Genetics in particular has allowed scientists to separate out the patterns of information that inform how biota are constructed out of matter from the matter that it is composed of by creating databases of genetic information on computers. This has allowed actual biological samples with "wet" DNA to be transformed into "dry" DNA on a computer database, where the information is much easier to make discrete and transferable (Thacker 2005). Technology has made biological resources into a highly transferable, and subsequently tradeable, commodity.

Yet the same technology which enables the trading of biological information has also made it more difficult to control access to biological resources. Publicly available genetic databases such as GenBank, which is accessed by approximately 40,000 people a day (Thacker 2005). Biological resources that have been cataloged, but not given a provenience, in databases such as this may loose their link to their natural origins. Especially given that developing countries may not have the resources to create an extensive database of their own or spend time tracking down biological resources in other databases which may have originated from within their territory, this presents challenges to states hoping to control access to their biological resources under the CBD. Another factor to consider is that the growth of biotechnology has largely been co-extensive with that of globalization, the growing interconnectedness between all areas of the globe (Thacker 2005). The growth of the internet has created networks which allow certain computer databases to be accessed from around the world. This has greatly facilitated

biological exchange, and the recent development of more global IPR regimes reflects that control over the intellectual property which results from this has needed additional help.

In considering Antarctic biota, regulating the bioprospecting of these biological resources through controlling access to the area may not be enough. Many biological resources from this continent have already been entered into biological databases, and more are on their way. During the International Polar Year of 2007-2008, one of the large projects to be undertaken is the Census of Antarctic Marine Life (CAML), which hopes to address questions about the biodiversity of the area by cataloging specimens and making them available in a large online database. Already, biotechnology firms wishing to work with Antarctic biota are not tied to visiting the Antarctic in order to collect samples (Graham 2005). Other Antarctic activities which have involved resource exploitation, such as the potential for mining, rely on the right of access since the natural resources that they seek to exploit do not reproduce themselves once away from the continent. It may be argued that this means that the ecological footprint of bioprospecting activities involved in Antarctic biota is also reduced, but it still does not address the key questions of who has the right to access these biological resources and for what purpose should they be exploited? Already patents based on the bioprospecting of Antarctic biota have been applied for within a number of different countries (Lohan and Johnston 2005). In such an environment where the information has already been distributed across various networks of knowledge, how can strict access controls subsequently be imposed? It could be argued that the sharing of information is in fact promoted by the Antarctic Treaty itself as Article 3 calls for the free exchange of scientific information between members (Treaty 1959). Since the biological resources of Antarctica are no longer all *in situ*, the

control over the intellectual property derived from them must no longer be an attempt to control access to a "source" location but global project instead.

Assumption #3: Solid Nature-Society Boundaries

In considering any IPR regime related to bioprospecting activities, the divide between what is natural and what is socially-influenced arises. This is because bioprospecting straddles the line between human innovation and the non-human world. Bioprospecting consists of the discovery of new organisms and the extraction and processing of their "useful" traits. The simple discovery of a useful organism is not grounds for the application of IPR, the scientists must subsequently invent something based upon it (Strathern 2001). This principle is reinforced by the definition of what constitutes a patentable invention for TRIPS in Article 27 (Agreement 1995). Article 2 of the CBD similarly defines biotechnology as a technological application that uses biological resources to create products for use (Convention 1992). This might be seen as "improving" the organism, but in any case the organism or process must be altered in some way from its natural state because the products of nature cannot be patented. This raises questions of how IPR discourses reflect or reinforce the divide between nature and society (Strathern 1996; 2001). Nature cannot be patented, but an invention based on natural processes or an "improvement" on nature can be. This can be seen as a part of a modernist project which attempts to "purify" hybrid objects which exhibit tendencies of both the natural and the social world into objects which can be more easily classified (Latour 1993). Modern IPRs have attempted to make the distinction plainer. Patent

offices and patent holders should be able to distinguish between what a natural process is in comparison to a human-induced one.

While it might be better for patent-holders to be able to claim their intellectual property as removed from nature, at other points in the production process are blurred again. When it comes to marketing a product, particularly a biological one, the claim that it is un-natural is a negative selling point, so biotechnology firms will revert to calling the product all-nature or that it harkens back to its "natural" sources (Thacker 2005). In promoting their ArcticExpress™ Competent Cells featuring cold-adapted technology, a full-page ad on the inside cover of the July 26 2006 issue of *Science* magazine informs the reader that aspects of the product are "provided by the Antarctic isolate *Oleispira antarctica*." The fact that the process works in nature sometimes indicates that it is safer to use than an experimental innovation which has presumably not existed for as long a time.

Currently, there are no distinctions explicitly made in ATS documents as to what is to be considered natural and what is to be considered the un-natural products of humans. It is acknowledged both that natural conditions greatly impact human life on the continent and that humans can affect their natural environment there. Weather conditions greatly impact when and how humans can access areas of Antarctica. Human-induced impacts on the Antarctic environment have been acknowledged and addressed to some degree. Issues of pollution and exotic species introduction have been dealt with, but no attempts have been made to purify the human-nature divide within Antarctica. Scientific activities which take place on the continent have generally acknowledged how humans have become incorporated into "natural" processes in the Antarctic. The growth of

human waste produced in Antarctica produced a boom in the Skua scavenger bird population, which then had the effect of higher penguin chick predation. Extricating the human factor from Antarctic ecosystems is a challenging task, and only seems to take place when property rights are on the line. While this might be an easier task in other parts of the world where the modernist project has led to stronger distinctions between what is natural and what is not, it becomes more challenging in Antarctica.

Incorporating these lessons into a new approach

From the evidence gathered above, it is clear that the assumptions which underlie a typical private ownership model of intellectual property rights would not form an adequate basis for any forthcoming Antarctic bioprospecting regime. State power is not the only viable political interest to be involved in bioprospecting governance and any reliance on borders to enforce property rights is misplaced in Antarctica. Regulating access to the Antarctic in order to control its biological resources is an ineffective measure given the proliferation of biological data in computer databases and knowledge networks. Finally, nature and society are blended together so often in Antarctica that it can be difficult to completely purify the two categories. Although the establishment of a bioprospecting regime is conventionally seen as a static contract which its members must adhere to, this will not serve. The question now arises: if the conventional approaches to IPRs and bioprospecting are insufficient to deal with the bioprospecting situation in Antarctica, what kind of model will work?

There have been several approaches proposed for bioprospecting in Antarctica. Julia Jabour-Green and Dianne Nicol propose six alternatives at the end of their article on the subject: commercial developers could pay an access fee, a common information clearing-house could be made, individual ATS member states could each create their own regimes, individual institutions could make arrangements with commercial partners, an "Antarctic Trademark" could be developed to identify the continent as the source of particular biota, and finally the ATS could retain full control over access, use, and benefit-sharing through a separate regime (Jabour-Green and Nichol 2003). While each of these proposals are somewhat innovative, they do not address all of the contradictions presented above. Melissa Weber expands on their idea of an "Antarctic Trademark" to propose an accreditation scheme which would involve the voluntary participation of the industries involved, but this scheme continues to be based on regulating access (Weber 2006). Bernard Herber finds both advantages and faults with the concepts of defining Antarctic biological resources either national public good or as a global public good (Herber 2006). All of these approaches are good starts to addressing the issue, but something a bit more radical is needed in order to account for the faults I addressed earlier.

The idea of forming a boundary organization which could undertake a hybrid management of the bioprospecting issue may be that radical step that is needed to address the failures of more conventional systems. Boundary organizations are institutions that exist in the liminal space between normally separate ways of life, for example an institution which joins together both scientific expertise and policy formation (Guston 2001). There are many different perspectives and institutions involved in bioprospecting

(Castree 2003), and juggling their points of view is best done at a site where all interests can be validated and understood. Beyond the definitional reconciliation of nature and society mentioned earlier, there has also been a tension within bioprospecting by individuals trying to separate out "pure science" that undertakes research solely for the growth of knowledge from the "commercial science" which seeks to make a profit from the acquisition of that knowledge (Graham 2005). There are different motivations that drive individuals to become involved in bioprospecting. Some promote IPRs because they believe that it is the granting of temporary monopoly rights over intellectual property which promotes innovation (Connolly-Stone 2005). Others critique IPRs because they are disproportionately weighted towards the interests of the patent-holders because of their formation under bargaining conditions of domination (Drahos 2002b). These boundary organizations serve as places where a productive tension may be formed between these points of view (Miller 2001). Different interests may be represented because the organization is not established under a single group's discourse or logic system. Because of this, boundary organizations are able to adequately address multiple interests in a number of different ways. According to Clark Miller, boundary organizations serve four important functions: hybridization, deconstruction, boundary work, and cross-domain orchestration (Miller 2001). These involve the blending together of interests and approaches as well as procedures to keep some things separate.

The hybrid management approach has the advantage of institutions which actively manage the issues in front of them rather than trying to stick to a static strategy of containment. In some ways, it acknowledges that these issues cannot all be forseen by a single treaty or document, and instead address new issues as they are brought up to the

boundary organization. This principle of actively incorporating change into governance also matches the principles of reflexive governance that Tom Dedeurwaerdere discusses (Dedeurwaerdere 2005). Such an organization is automatically set up to address a wide range of political actors. It could also make good use of biopolitics with the recognition that borders are not always solid, but the individuals that traverse them are the most valuable vessels of power that there are. In this way, such an organization would not seek to control biological resources by limiting access, but by changing the actors involved through active negotiation and individual agreements which can be understood within each logical framework that the boundary organization encounters. Such a flexible, active model of institutional governance could be exported for use in other situations because while Antarctica presents definite challenges to the private ownership model of IPR and the conventional agreements that are built upon it, the flaws of the model are present everywhere and cannot be fixed by static minds.

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