

**Accounting for Ecosystem Flows:  
Setting a Standard for Australian Industries to make Sustainable Decisions**

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## **ABSTRACT**

This paper explains the System of Environmental and Economic Accounting's (SEEA) approach to environmental accounting flow systems and how this system is now being utilized in the creation of new Australian standards of accounting. The first part of the paper discusses in depth different accounting systems, primarily physical and hybrid accounting systems, as they relate to the measures set forth by the SEEA. The second part analyzes the differences between the SEEA's gross accounting system in comparison to the Intergovernmental Panel on Climate Change's (IPCC) net accounting system. This includes a type of "pro-con" way of looking at which is more useful and pertinent to the future of environmental accounting systems. After explaining the different positions of the SEEA and the IPCC, there is a discussion of harvesting-types and producing-types of environmental industries and whether or not these industries have ownership of the environmentally produced natural resources and therefore ownership of the carbon sequestered within these carbon sinks. The last section of this paper is where the debate lies. At this point in time, no consensus has been reached about which accounting method is best for providing environmentally sustainable decisions. Similarly, no decision has been made about who actually can claim ownership over specific environmental resources and which parts/ to what extent they may own these resources.

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### Abbreviations

ABS – Australian Bureau of Statistics

CSIRO – (Australia's) Commonwealth Scientific and Research Organization

GDP – Gross domestic product

IPCC – Intergovernmental Panel on Climate Change

ISA – Integrated Sustainability Analysis

NDP – Net domestic product

NGGI – National Greenhouse Gas Inventory

SEEA – System of Environmental and Economic Accounting

SNA – System of National Accounts (United Nations)

### **3. INTRODUCTION**

The research done during the course of my independent study project dealt with learning about and analyzing different accounting systems for environmental accounting utilized within the Australian government. More specifically, my research focused on how different accounting systems are used and can be manipulated to provide different results for the impacts that industries have on the environment. This information is pertinent to our current environmental situation both within Australia and throughout the world.

This research is relevant in conjunction with principles of triple bottom line reporting. Currently, the Australian government, in conjunction with the University of Sydney and Australia's Commonwealth Scientific Research Organization (CSIRO), is in the midst of creating and refining software to help business assess their decisions environmental sustainability. Thus, these groups are looking to find more information to better assess the impacts of specific industries on ecosystems. My research provides an in-depth look the ecological and economic factors that need to be considered when businesses and industry are assessing their sustainable business decisions. The ultimate goal is to create a more solid standard for environmental accounting in Australia.

#### *3.1 Background*

As far as the forestry industry goes, this is a business that many people in Australia associate with being somewhat "green" based on the fact that they are engaged in carbon sequestration. In reality, this industry has a significantly negative impact on the environment. For this reason, and especially in recent years, there has been a greater push to make the industry more environmentally sustainable. For example, in the late

1990's, \$120 million (AUS) was set aside by the Australian government for forestry industry restructuring, as well as an increase in funding to reduce the saw log supply and to accelerate the establishment of hardwood plantations (*Willis, 1998*). One group in particular has taken the initiative to push these ideas into actions; the Victorian Association of Forest Industries put forth their *Vision 2005: Healthy Forests, Healthy Forest Industry* plan. Much of this plan discusses elements of triple bottom line reporting. *Vision 2005* suggests that the industry needs to take into account economic (forest industries, fiber and wood products, and tourism), environmental (biodiversity, air, water, soil, and national parks), and social (regional and timber communities, consumers, and visitors) factors when making business decisions (*Victorian Association of Forest Industries, 2005*). As evidenced by the Victorian Association of Forest Industry's initiative, the future of environmentally sustainable decisions will encompass the economic, environmental and social fields equally. The fact that these ideas have been suggested is an indicator that TBL will be tremendously relevant to sustainable development in the future.

The Integrated Sustainability Analysis (ISA) group at the University of Sydney has conducted similar analyses in the past for other industries. The previous analysis utilized by the ISA group uses conventional (monetary) National Accounts, physical satellite accounts, and input-output techniques in order to characterize 135 industry sectors in terms of four financial, three social and four environmental indicators (*Foran, 2005*). The positive indicators include gross operating surplus, exports, income, employment, government revenue, and upstream linkage, while the negative indicators include primary energy consumption, greenhouse gas emissions, water use, land

disturbance and imports (*Integrated Sustainability Analysis, 2005*). The indicators are enumerated in a full-supply-chain context, where the intensities of each of the indicators are taken into account. The results are then presented as tables, and visually as spider diagrams and bar graphs. In conjunction, the eleven indicators provide a macro-landscape of the Australian economy against which many industry management issues can be benchmarked.

The *Balancing Act* study distinguishes three forestry-related industry sectors: 1) State forestry, 2) hardwood plantations, and 3) softwood plantations. With regard to their greenhouse gas emissions indicator, these sectors are characterized within *Balancing Act* by relatively high values of about 95, 15 and 25 kilograms of carbon dioxide per Australian dollar, respectively, which exceed by far the economy-wide average of about 1 kilograms of carbon dioxide per Australian dollar (*Foran, 2005*). Most of these greenhouse gas emissions are caused directly during harvesting; they are reported in the Australian National Greenhouse Gas Inventory (NGGI) under category class ‘5.A. Changes in Forest and Other Woody Biomass Stock’.<sup>1</sup> While *Balancing Act* reports gross emissions, the NGGI reports both emissions and sinks, as well as net emissions (emissions minus removals). Usually, gross emissions during harvesting are more than offset by removals from carbon dioxide sequestration during forest growth: Creating timber products basically “locks away” carbon, at least temporarily, so that short-term ‘emissions’ are negative. As a result, for example in the 2000 NGGI, class 5.A. shows a total net removal of about 24 Mt carbon dioxide (*Foran, 2005*).

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<sup>1</sup> Even though forestry sectors may carry out some land clearing reported under ‘5.B. Forest and Grassland Conversion’, this item was not allocated to any of the forestry sectors, but to beef cattle grazing.

This research initiative has evolved in response to the forestry industry's reaction to a paper written by the ISA entitled *Balancing Act*. Essentially, the forestry industry criticized the way that the ISA analyzed the connection between the economic and environmental ramifications of their actions. The major problems that the forestry industry had with the ISA's analysis come from the fact that there are no standards of environmental accounting in Australia. Thus, there is no accountability of industries to behave in a specific way with respect to considering environmental sustainability. The initial discussions led the authors of *Balancing Act* to publish an explanation and clarification of TBL. In summary, in its reporting on many physical indicators, *Balancing Act* follows environmental accounting procedures applied by the Australian Bureau of Statistics (ABS), which in turn are based on the System of Environmental and Economic Accounting (SEEA), which is a complement to the UN System of National Accounts (SNA). This system separates physical flow data into supply and use tables. These tables report only gross flows, and in this respect they match the economic input-output tables. On the other hand, the NGGI is based on reporting formats set out by the Intergovernmental Panel on Climate Change (IPCC), where the final figures reflect net emissions.

Even though a qualifier was inserted in the forestry-related sections, *Balancing Act* shows only gross emissions, because this reporting practice is in line with National Accounts. As a result, in *Balancing Act*'s prominent spider diagrams, forestry is portrayed as being one of the highest emitters in the economy. As stated earlier, this stands in sharp conflict with the perception of forestry, both within the sector and the general public, as a green industry that helps sequestering carbon out of the atmosphere.

In following neutral accounting rules, *Balancing Act* had unintentionally opened a debate that put environmental accounting into the focus of national environmental policy.

For purposes of this paper, we will be looking specifically at the interaction between the economic and environmental spheres for triple bottom line reporting not only as it applies to the forestry industry but also as it applies to all industries that are directly related to the environment. The body of the paper is organized as follows: Section three introduces the System of Environmental and Economic Accounting (SEEA), and how environmental flows are dealt with. Section six contains the centerpiece of our argument, in that it structures and critically discusses various aspects of the debate between net and gross accounting from different perspectives. Finally, section seven initiates a discussion about whether or not industries that directly utilize natural resources have ownership of these natural resources and therefore ownership of the carbon sequestered within these carbon sinks.

There are a few definitions that will be helpful to have when reading this paper. First, environmental accounts are an information system or framework that links economic activities and uses of a resource to changes in the natural resource base. Second, a flow account is a general term used for environmental accounting framework, which presents information on the physical flows resources throughout the economy. Third, input-output analysis is a compilation method that provides a description of the inter-industry flows of goods and services within the economy and the structure and interrelationship of industries. Finally, national accounts are a systematic summary of national economic activity, including both flows and balances. At a more detailed level, national accounting shows a statistical picture of the structure of the economy.

#### **4. METHODOLOGY**

This project was conducted over the period of one month at the University of Sydney. During this time, I spent every day working at the university with the members of the Integrated Sustainability Analysis team researching my study question. Based on the fact that this is a relatively new field, it was necessary to spend time with the members of the ISA team to discuss different ideas and approaches that needed to be considered in conjunction with a full analysis of the interaction between the ecological and economic spheres of study.

In order to gain a full understanding of all of the economic concepts that were applied to ecology and environmental sustainability, I spent a lot of time reading through the SEEA and SNA documents that explained their system of environmental accounting. This type of systemic analysis was all so necessary regarding the IPCC's environmental accounting system. By examining these two different approaches to accounting systems, I was able to form a more complete understanding of the different options the forest industry has in determining their environmental sustainability levels.

Once the economic analyses were complete, the next step was to connect these ideas to the environmental aspects of industry actions. As you will see, this was a difficult task considering the fact that economic accounting is done in monetary terms while strict ecological accounting is done primarily in physical terms. There is an attempt to bridge the gap between these two schools of thought.

The next step was to consider the perspectives of the stakeholders in the industries that are directly involved with natural resources. This showed a broad illustration of the different ways that the accounting systems could be used, thus proving that some type of

consensus is needed in order provide a standard scale that all can use when making sustainability decisions.

Logically, an examination of the moral and legal implications of creating an international standard for sustainability analysis followed. The ideas of how exactly nature should be valued came into consideration here. Furthermore, it was necessary to consider the questions of ownership, the involvement of industries in ecosystem flows as well as their stated purpose of operation in order to gain a well rounded sense of the ramifications of future resolutions for sustainable decision-making.

## **5. ACCOUNTING OF ENVIRONMENTAL FLOWS: THE SEEA**

### *5.1 The role of the SEEA as a guide to environmental accounting:*

The System Environmental and Economic Accounting (SEEA) emerged from the 1993 United Nation's System of National Accounts (SNA) as a satellite system (*Smith, 2006*). The original SNA international guidebook on national accounting was created to provide a system for compiling, analyzing and integrating both environmental and economic data with the intent of using that information to aid in the creation of sustainable policies. The ultimate purpose of this initiative was to create a set of standards to be used by all industries in Australia when assessing environmental sustainability. In creating the SEEA, the United Nations sought to modify, elaborate, and extend the principles, concepts, and classifications used by the SNA in order to effectively represent environmental statistical economic data (*United Nations 2003*).

There are several key factors rationalizing the creation of the SEEA. By creating an accounting framework, economists and policy makers will have a standard system in which to evaluate which environmental inputs are the most critical to the economy as well as the reciprocal effects that economic activity has on those environmental inputs. In addition, this system will help to target specific industries and groups that contribute to environmental degradation. The SEEA also provides a way of comparing and integrating both the physical and monetary factors in a hybrid flow account, which helps connect environmental and economic fields (*Smith, 2006*). The culmination of this process will expectantly be the creation of a system of asset accounts that will help people to address issues of environmental sustainability.

The SEEA draws upon elements from all three of the major concepts and principles of sustainable development in its accounting process (*Hecht, 2007*).<sup>2</sup> The synthesis of these approaches has resulted in a focus on the relationship between the economic and environmental spheres and especially on the measurement of natural capital. This accounting process, as seen in the SNA, has been done on a macro level in order to integrate both the economic and environmental data more effectively. At a more detailed level, there are four categories of accounting in the SEEA system. The first category concerns two different types of accounts; physical and hybrid flow accounts. While physical accounts are more straightforward (data regarding flows of aggregates such as energy and materials), the hybrid flow accounts are the result of the combination of both economic and physical statistics (*United Nations 2003*). The second category is based on environmental transactions and economic accounts. More specifically, this

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<sup>2</sup> The major concepts of sustainable development include the three pillar approach, the ecological approach, and the capital approach.

category is meant to use existing components of SNA that are pertinent to good environmental management and to make them more precise. The economic accounts will more explicitly focus on expenditures from business, government and households in order to discover environmental strains as a result of economic activity. The third category relates physical terms to monetary terms in asset accounts. Essentially, this group entails the valuation of natural capital, which is comprised of natural resources, land and ecosystems. The final category discusses ways in which initial aggregates from the SNA can be extended.<sup>3</sup> An important factor to understanding the flows between the economy and the environment is to realize that just as the economy is an entity unto itself, the environment is also its own entity as a source of economic assets used in accounting flows.

### *5.2 How the SEEA deals with environmental flows*

The SEEA employs the use of two major types of flow accounts, physical flows and hybrid flows. Both of these flow accounts show the flows between the economy and the environment. Hybrid flows utilize mechanisms of physical flows in conjunction with monetary terms of national accounting. In both of these systems of accounting, it is important to point out the entity of the environment as an actor in flow representations. A basic representation of this concept can be seen in figure 1, below. This figure shows the flows from the environment to industry in the form of ecosystem service. Ecosystem services are then utilized by industry to produce materials for industry supply and industry use.

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<sup>3</sup> This category deals with the ways that the economy impacts the environment and cites three specific ways that SNA aggregates can be extended; (1) to account for the depletion of natural resources; (2) to avoid defensive expenditure (e.g. the avoidance of using the “sink” function of the environment); and (3) minimize environmental degradation.

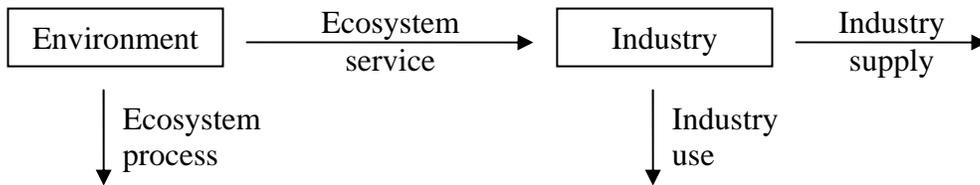


Figure 1: Simple flow diagram, representing flows from the environment into the economy (\*see Appendix A for more detailed information in the form of a table\*)

Physical flow accounts are comprised of flows within and between economic and environmental fields. When looking at these flows of interest, it is important to keep in mind that the economy as an entity is characterized as both a local economy as well as an economy encompassing the “rest of the world.” The SEEA uses four different types of flows of interest in its physical accounting practices; products, natural resources, ecosystem inputs, and residuals. Most relevant to environmental flows are natural resources and ecosystem inputs. We will discuss products as well as supply and demand in greater detail in the following section regarding monetary flows. Products are goods and services that are both supplied and used by the economy. Natural resources are demanded by the economy and supplied only by the environment. Ecosystem inputs are similar to natural resources; however, they are different in that they are counted when expended in another region of the “rest of the world” economy. Finally, residuals are the negative byproducts of economic activities that result from both production and consumption. Residuals flow from the economy into the environment in the form of pollution.

It is possible to look at physical flows within their own entities and in combination together. The economic flows are characterized in the classic economic sense of a circular flow of income and the interdependence between economies. When linking the environmental and economic flows, there is a movement of natural resources as well as ecosystem inputs from the environmental sphere to the economic sphere. At the same time, there is a flow of residuals from the economic sphere to the environmental sphere as shown in figure 2, below.

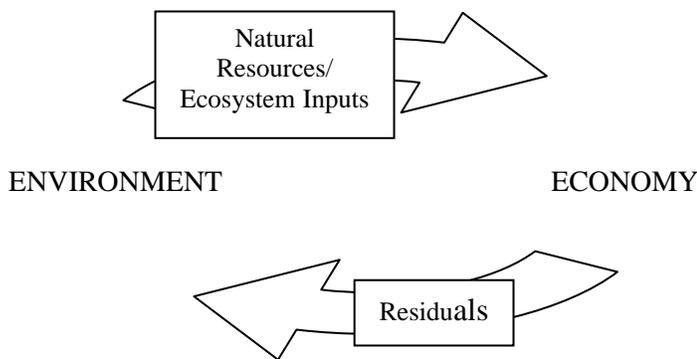


Figure 2: Diagram of flows between the environment and economy

Hybrid flow accounts are a combination of physical flow accounts with monetary terms of national accounts. This is done in order to provide a consistent evaluation of measuring environmental costs to economic benefits and vice versa in monetary terms that are more easily understood on a systematic level. Thus, hybrid flow accounting has the ability to connect economic and environmental schools of thought so they may be analyzed in conjunction with one another. There are two types of hybrid flow accounting that are utilized in the SEEA: input-output tables and supply and use tables. Input-output tables provide a more concrete method of viewing hybrid flows that allow for additional comprehensive understanding of hybrid flows. These input-output tables will be discussed in greater detail in section 5.3. Supply and use tables have the capability of

being represented by both physical units as well as monetary units, thus making it necessary for the analyst to choose which unit will be used during the study.

Furthermore, supply and use tables focus on the direct relationship between production and consumption. Values of products, the cost of labor and capital as well as physical inputs of natural resources and ecosystem inputs are analyzed in contrast with values of products and physical measures of residuals. Hybrid flow accounts are able to show a more explicit relationship between industry production and the generation of residuals. This is done by either showing supply and use by industry or the supply and use of products. In analyzing just one category at a time, it is possible to target the causes of residual production and where exactly they are occurring.

A good way to illustrate the systems of physical flow accounting and hybrid flow accounting systems is through the example of Australian water accounts. The Australian Bureau of Statistics (ABS) has published the Water Account Australia handbook that shows the supply and use of water in the Australian economy. This publication was created according to the SEEA methods. The analysis shows the flows within the economy and between the economy and the environment. Within the economy, there is movement of mains and reuse water from providers to users as well as flows from water users to water providers in the form of swage and wastewater (*Trewin, 2004*). Between the economy and the environment is the movement of both the regulated and unregulated discharge of water from providers and users to the environment. There are also flows of self-extracted water from the environment to both water providers and water users. Those entities that provide water services also require the use of water. Thus, they contribute to the overall extraction and use of the water resource taken from the

environment. The use of water by these groups is counted in a variety of ways including leakage, evaporation, hydro flushing, and etcetera (*Trewin, 2004*). Although not portrayed in this flow analysis, within the environment, there are residual flows between environmental systems.

### *5.3 The synergy between the SEEA and input-output impact analysis*

As stated previously, the SEEA also provides a way of comparing and integrating both the physical and monetary factors into a hybrid flow account through input-output tables, thus helping to connect environmental and economic fields. This method of analysis draws very strongly on gross accounting systems emphasizing direct<sup>4</sup> and indirect<sup>5</sup> environmental impacts as separate entities. The way that these input-output tables work is by calculating the sum of the direct and indirect impacts on the environment, which amount to the total impact on the environment by that industry. These analyses can be done for each of the ten indicators discussed in the introduction, thus providing a comprehensive analysis of the gross environmental impacts through economic accounting.

One example of input-output accounting can be seen in the water supply industry. In this analysis, water use was calculated to include the combination of mains water use, self-extracted water use and reuse water use (*Trewin, 2004*). Water consumption was calculated as the removal of water supplied to others as well as in-stream water use from water use (as calculated above). These ideas were then applied to the Australian economy showing water providers as water supply, sewerage and drainage service

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<sup>4</sup> Direct impacts are found by dividing an indicator (from the list of ten mentioned in the introduction) and dividing that indicator by the gross output of the industry.

<sup>5</sup> Indirect impacts are found by multiplying how much of an indicator is used by the amount of supplies an industry is taking from other industries.

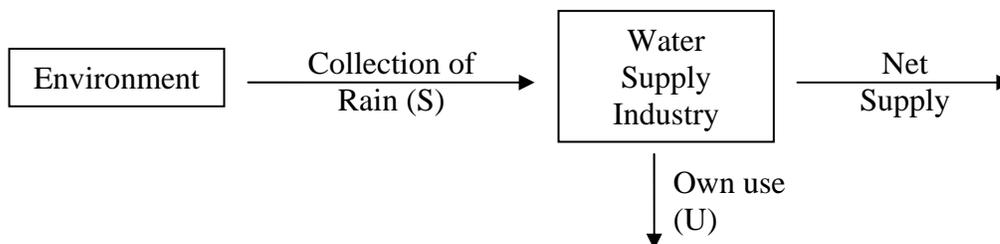
industry as well as some mining and electricity and gas supply businesses. Water users were considered to be entities belonging to household, agriculture, mining, manufacturing and other industries (including use by water providers).

## 6. COMPARISON OF NET AND GROSS ACCOUNTING SYSTEMS

### 6.1 The SEEA accounting of emissions

As we have seen, the SEEA's accounting system is comprised of flow accounts, asset accounts, and macroeconomic indicators. The SEEA reports gross sequestration as well as gross emissions as two separate figures in their final analysis (*Hecht, 2007*).

According to this accounting system, gross sequestration is an action that is taken by the environment, while gross emissions are the result of industry actions. An example of this can be seen with the water supply industry in Figure 3 below. For gross accounting, the supply (S) is subtracted from the use (U) by the water supply industry.



**Figure 3: Flow diagram of gross water use by the water industry**

There are a few different reasons for why the SEEA has chosen the route of a gross economic analysis system.<sup>6</sup> When looking at supply and use tables, we can clearly see that monetary accounts are not included in these analyses. This is a function of the fact that there are no monetary equivalents to the physical accounts that are being analyzed. However, the main reason why the SEEA focuses primarily on physical asset accounts is because it is so difficult to value natural resources, thus presenting a large challenge for constructing a monetary accounting system in which to analyze natural resources.

There are arguments from both environmental and economic standpoints for using GDP measurements as an indicator of environmental sustainability. Environmentalists find utility in this analysis for providing a continual tracking of the benefits derived from nature over time. Furthermore, it is important to have a way of quantifying the well-being provided by nature. From an economic standpoint, the GDP is useful for calculating how well the market economy is doing (*Boyd, 2006*).

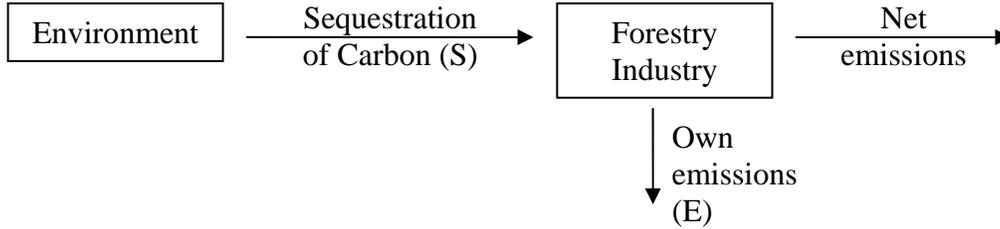
Where the SEEA's accounting system deals primarily with the gross economic accounts, the IPCC offers an alternative economic analysis in terms of net accounting.

### *6.2 The IPCC accounting of greenhouse gas emissions*

The IPCC reports net emissions in its final analysis. The net emissions are found by subtracting the sequestration of carbon from the industry's total emissions (*Heal, 2007*). An example of this can be seen with the forestry industry in Figure 4 below. For net accounting, the net emissions are found by subtracting the amount of sequestered carbon (S) from the industry's own emissions (E).

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<sup>6</sup> The gross domestic product is essentially an indicator of how much the market economy produces as well as what the market economy is worth (*Boyd, 2006*). More specifically, GDP measure the quantities as well as the prices of goods and services.



**Figure 4: Flow diagram of net greenhouse gas emissions of the forestry industry**

One reason for the IPCC’s use of net accounting might be the ability to more easily manipulate the data and numbers to create a desired outcome.<sup>7</sup> There are several different definitions of forests that included different criteria. In a similar way, it is also possible to choose which human induced activities are contributing to carbon output. These two example are only a few of the different choices that can be made that ultimately allow for vastly different results in analyzing green house gas emissions output. A more specific example of this is seen in the debate between fire assisted pastoralism versus sustainable forestry as outlined in the paper written by David Ockwell and Jon Lovett. When doing a cost benefit analysis of fire assisted pastoralism the net present value was higher when carbon sequestration was included (*Ockwell, 2004*).

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<sup>7</sup> There is a basic difference between gross domestic product (GDP) and net domestic product (NDP). In NDP, the changes in capital are not subtracted from the GDP.

## **7. ACCOUNTING PRINCIPLES VS. INDUSTRY PERSPECTIVES**

Now that we have established the different ways in which groups approach environmental accounting, as well as the two major systems employed by the SEEA and the IPCC, we reach the question of, why do these accounting systems matter? Recently, there has been a major push for environmental awareness within Australia as well as the initiative to stop global warming. This is all evidenced by the creation of protocols including the Kyoto protocol and the Montreal Protocol as well as annual and bi-annual environmental summit meetings. Clearly, this is a pressing issue not only for Australia, but around the world. The concepts of carbon trading are also being honed at present time and will most likely be a very important to creating environmentally sustainable business decisions. Thus, establishing accounting systems is very relevant to that market. Furthermore, many industries and companies are realizing the benefits, in terms of public image, of being branded as a “green” company.

The threat of environmental degradation is very real and therefore, we must begin to think about ways in which businesses, industries, governments, and world citizens are going to be held responsible for their wrongs against the environment. In order to begin taking the steps to physically stop and reverse the damage being done to the environment, we must first lay a policy foundation. An important component of this movement is to examine the issues of property rights, the involvement of businesses and industries in ecosystem flows and to scrutinize the actual stated purposes of industry operations.

### *7.1 Legal ownership*

According to the Australian government, natural resources in legal terms are owned by the public. However, State and Territory governments within Australia

manage the natural resources by licensing provisions for access and distribution (*Commonwealth of Australia, 2002*). Now, we run into a few problems with natural resource industries. There are eight specific industries that will be examined for the purposes of this discussion. These eight industries belong to two different categories: industries that are considered to be “harvesting-type”<sup>8</sup> and industries that are considered to be “producing-type.”<sup>9</sup> Harvesting-type industries include fisheries, native forestry, water supply, and mining. Producing-type industries include fish farming, plantation forestry, water desalinization, and recycling. Let’s look at the example of the forestry industry. There are two different entities within the industry. First there is the harvesting-type industry of native forestry, and second is the producing-type industry of plantation<sup>10</sup> forestry. These two sectors of the forestry industry are both taking trees from the environment to sell within economic markets as a product. As we know, trees in their natural process sequester carbon by taking carbon-dioxide from the atmosphere to use in photosynthetic processes. Now we can look at the question of ownership and see the impending conflict. Because the forestry industry is selling trees from the environment on the economic market, does this mean that they inherently own the trees they are selling? If these groups do own the trees then do they not also naturally own the carbon that is sequestered within those trees? If forestry industries own the trees and their sequestered carbon then should they not also be allowed to count the sequestered carbon against their net emissions? As you can see, the idea of ownership is a very

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<sup>8</sup> Harvesting-type industries are industries solely take from the environment and are not actively involved in restocking or replenishing that natural resource that has been taken from the environment.

<sup>9</sup> Producing-type industries are industries that both take resources from the environment while are simultaneously involved in replenishing these natural resources.

<sup>10</sup> Plantation forestry occurs when the group harvesting the forest is actively involved in replanting or seeding of the forest that has been removed.

difficult concept to define and especially when it comes to the environment because it is fraught with moral undertones.

### *7.2 Involvement of industries in production process*

The line between harvesting-type industries and producing-type industries is more apparent when discussing ideas about the involvement of industries in the production process. In this case, we are not talking about the economic definition of production as in a good or service. Involvement in the production process implies that the industry is taking an active role to replenish the natural resources that they have reaped from the earth. Once again, using the forestry model we can see clear distinction between native forestry and plantation forestry in terms of their involvement in production. The plantation forestry industry is taking an active role in replanting the trees that they harvest, while the native forestry industry merely takes the resource from the earth. An important idea to keep in mind is that although the plantation forestry industry is actively putting the seeds into the ground for the trees to grow, it is ultimately the Earth and the Earth's processes that cause the trees to grow. In the case of fisheries versus fish farming, the fishery industry simply takes the fish that they catch, while fish farming entails not only the capture of fish, but also the replenishment of the fish stock. Now that we have established the line between the two types of industries, does it make sense that those producing-type industries should legally have less of an impact on the environment? While producing-type industries are replenishing the supply of resources, they are still taking natural resources. Is it more acceptable to allow these industries to

claim lower environmental impacts than it is to give them ownership of natural resources?<sup>11</sup>

### *7.3 Stated purpose of industry*

The stated purpose of industry is the most complex and abstract idea in question. When a company sets to work in their given field, what is their intent? Most people would think that the purpose of that company is to work in their industry and to provide goods and services on an economic in order to turn a profit. Now, this idea needs to be linked to ideas of environmental sustainability. As industries jump into the world of carbon trading, carbon sequestration is going to be a hot commodity. Is it appropriate for a company who has the ability to claim sequestered carbon to state this as a business objective? Ultimately, money is what is driving their actions, so is sequestration as an intention technically accurate? There is a distinction here too between producing-type and harvesting-type industries. In the case of native forestry, while the industry may theoretically be able to claim sequestered carbon in the trees that they are cutting down they are simultaneously depleting a natural resource. On the other hand, plantation forestry might theoretically claim sequestered carbon in the trees; however, they are replenishing the resources that have been taken. Does this mean that the plantation forestry industry has more of a right to claim that the purpose of their business is to increase carbon sequestration? At the same time, the growing trees are simply fulfilling their life functions by sequestering carbon. In no way are they manipulated to sequester carbon outside of their normal role; these actions are purely a natural process.

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<sup>11</sup> For a visual of the theories behind ownership and involvement in production process, see Table 1 in Appendix A.

## **8. CONCLUSION**

Based on this research, it is easy to see that some major work needs to be done to create a basic policy structure by which businesses and industries can assess their decisions in an environmentally sustainable manner. There are several different accounting systems that can be considered in this process all of which have both positive and negative aspects. However, there still exists the conflict between the accounting systems when attempting to link the disciplines of ecology and economics. This relationship and how it will evolve is beginning to become a discussion hotbed. As of now, there are no concrete conclusions on how precisely these two fields should interact with one another.

Unfortunately, in the end, the decisions to be made are going to require some moral and ethical input, which may hinder the process thus only allowing it to progress at a lethargic pace. Furthermore, it is going to require that all people involved in this type of project make some important paradigm shifts in their attitudes toward the environment in order to ensure an effective system is created.

If Australia is able to produce a system for creating environmentally sustainable decisions, this will be of highly significant use to the country and for the wellbeing of its citizens. Furthermore, this type of system may also become a benchmark for other countries and eventually significant to the creation of an international standard.

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**APPENDIX A**

Indicator	Environment	Ecosystem process	Ecosystem service	Industry	Industry use	Industry supply
CO <sub>2</sub>	atmosphere	ecosystem sequestration	forest growth	State forestry	decaying or combusting slash	timber, firewood, wood products
			plantation growth	plantations		
Energy	atmosphere, biosphere, geosphere	wind, waves, heat, light, biomass	fossil biomass	coal, oil and gas mining, refining, fossil-fuelled electricity	losses, operational energy	useful energy
			available wind, waves, light, biomass	renewable energy transformation		
Fish	marine life	marine trophic chains	natural fish population growth	trawling, line fishing, squid jigging	bycatch	seafood
			fish rearing	fish, oyster etc farming	feed	
Water	atmosphere, clouds	rain runoff	rain on catchment	water supply	leaks, filtration, evaporation	metered water
		condensation	condensation through cloud seeding, rain on catchment	rain and water supply		

Table 1: Realizations of the flow diagram in figure 1 described by four indicators, divided into one harvesting-type and one producing-type industry for each indicator.