REGIONAL SCALE ADAPTIVE MANAGEMENT: LESSONS FROM THE NORTH EAST SALINITY STRATEGY (NESS)

Catherine Allan
Johnstone Centre, Charles Sturt University, Albury, 2604
Allan Curtis
Social Sciences Centre, Bureau of Rural Sciences, PO Box E11, Kingston ACT 2604

Summary

Adaptive management is an approach to managing natural resources which actively seeks to learn from implementation of policies and strategies. Originating in the discipline of ecosystem management, active adaptive management is associated with large scale, holistic experiments and multi-disciplinary, participatory, social learning activities. The theory of adaptive management has become popular in the last two decades because it 'promises' to facilitate management in the face of uncertainty and complexity, to increase flexibility and openness to surprises, and to democratise decision making.

This paper describes the authors' attempts to understand adaptive management in relation to the implementation of a salinity management program in north east Victoria between 1997 and 2001. The North East Salinity Strategy (NESS) appeared to offer excellent conditions for adaptive management. We sought to understand its program logic through document review, semi-structured interviews and a focus group, and in the process looked for signs of adaptive management. The NESS program logic was sound, and it achieved progress towards many of its goals. However, only a very passive form of adaptive management was operating in the NESS project.

We suggest that a culture of reflection was absent from the NESS. Reflection was inhibited by institutional arrangements such as reporting requirements and funding processes, and by social norms which separated implementation from research, and equated rationality of action with certainty of outcome.

A hypothetical NESS is proposed to highlight the differences between the current conventional, passive approach and one based on active adaptive management. We suggest that any change from passive to active adaptive management will need substantial effort to overcome the identified barriers. Sharing knowledge and experiences of adaptive management is a key to better understanding and using active adaptive management of our natural resources.

Introduction

Since the term "adaptive management" was coined in the late 1970s it has come to encompass three separate approaches to managing natural resources, described as evolutionary, passive and active (Walters & Holling 1990). *Evolutionary adaptive management* is eventual learning from experience, or trial and error. *Passive adaptive management* is more directed, using lessons from history to develop a single best policy to apply in practice. Evolutionary and passive adaptive management are common approaches to managing natural resources. *Active adaptive management* is a change in the way management is undertaken. It is an approach to natural resource management that consciously uses policy and implementation as experiments, designed to enable people to learn about systems as they manage them (Lee 1993b; Walters & Green 1997; Johnson 1999). It arose from within the ecosystem management discipline as part of an attempt to address perceived issues of scale, uncertainty and some limitations of reductionist science (Holling 1978).

Active adaptive management has become a popular topic in North American and European natural resource management literature because it promises a number of things needed by today's natural resource managers. Adaptive management appears to offer a way to manage resources sustainably in the face of uncertainty and complexity through increased management flexibility and openness to surprise (Holling 1995; Gunderson 1999). Because adaptive management is premised on experimentation, learning can happen more quickly than the slow accumulation that occurs during conventional management (Lee 1993a). Adaptive management also fosters learning from large scale experiments to increase understanding of real world interactions (Walters & Holling 1990; Carpenter 1998). Democratisation of management is another consequence of adaptive management, via enhanced community involvement in informed decision making (Lee 1993b; Roe 1996).

Adaptive management is said to underpin most natural resource strategic planning in Australia (Alexandra et al. 1998). The conditions of uncertainty and complexity that fostered the development of adaptive management overseas are also present in Australian natural resource management. Dryland salinity, for example, presents a regional scale problem which is complex and poorly understood, and the management of which needs the involvement of many stakeholders from different backgrounds and disciplines.

This paper describes our attempt to understand the use of adaptive management within a typical regional scale implementation program, the North East Salinity Strategy (NESS). We also used this case study to explore what an active adaptive management approach to a regional scale problem would involve, and what factors might constrain the application of active adaptive management.

The North East Salinity Strategy
Background

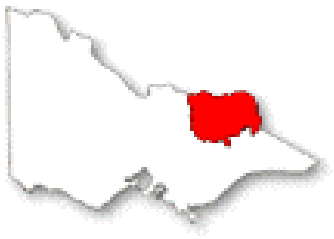

Figure. 1 North East Catchment Management Authority area Victoria

The north east catchment management authority area of Victoria encompasses the Upper Murray, Kiewa and Ovens River Basins, and provides 38% of the water of the Murray-Darling river system (North East Catchment and Land Protection Board 1997, p15) (Figure 1). Picturesque alpine areas, and productive foothills supporting horticulture and vineyards ensure that tourism is an important regional industry (North East Catchment Management Authority 2001). Over half the region is forested, but agriculture is a dominant landuse in the 500-1200mm rainfall zone. Much of the highly modified landscape supports sheep and cattle grazing in the eastern uplands, with some cereal cropping in the west. An unintended consequence of the land modification is dryland salinity, which is an emerging problem for the region (Lumsden & Reid 1996).

Dryland salinity was of little importance in the north east until the 1990s (Department of Conservation Forests and Lands 1988), and funding from the Victorian State Salinity Initiative was not available to the region (Reid & Cheng 2001). However, salinity emerged and spread, and in 1994 the North East Salinity Working Group (NESWG) formed to develop a strategy to address the problem. The NESWG included Landcare representatives, individual farmers, and staff from various government agencies. While acknowledging the dearth of local hydrogeological and salinity related information, the NESWG published the NESS in draft form in 1997. The NESS was approved, unchanged, by the Victorian State government two years later (Clifton et al. 2000). The objective of the NESS was ‘to control salinity in the North East Region for the benefit of the environment, local communities and downstream users for future generations (North East Salinity Working Group 1997, p28).

The NESS made no claims to use adaptive management, but passive adaptive management was implied by its program logic. Dryland salinity was a catchment scale problem that was complex, and the way forward was uncertain. Regional stakeholders needed to learn about dryland salinity as quickly as possible, both to address the issue effectively and to access funding. At the same time, there was a long history of widespread and effective involvement of community members, particularly through Landcare, in natural resource management in the region (Curtis & Van Nouhuys 1999).

The NESS review

The authors were commissioned to evaluate the NESS implementation from the strategy release in 1997 until December 2001. Our review focussed on assessing the NESS program effectiveness, and we attempted to make judgments about the extent to which the NESS accomplished program goals and addressed stakeholder needs. We also used the opportunity to reflect on adaptive management in the implementation of the NESS.

The original NESS document contained 56 general and specific recommended actions, from which we articulated seven goals (see Box 1). Progress towards these goals was evaluated with reference to a number of topics. These were developed deductively from the State guidelines for the review of salinity plans (Catchment and Water Division, DNRE 2000), and inductively as new topics arose during data creation (See Box 2).

Box 1 NESS Goals

1. Develop a better understanding of salinity processes
Activities directed towards achieving this goal included ground and surface water monitoring, discharge and recharge mapping, and hydrogeological interpretations and predictions.

2. Develop a better understanding of management options
Activities included trials and demonstrations of vegetative options such as alley farming and lucerne establishment, and investigations into engineering options such as sub-surface drainage and groundwater pumping.

3. Raise awareness of salinity and promote sustainable land use
This included awareness raising activities and general promotion of current recommended practices. Activities directed toward achieving this goal usually included 'encourage' and 'promote' in relation to recommended practices.

4. Build skills and capacity for change
This goal encompassed training activities that increased individual land manager and community group skills. It also included activities which sought to reduce financial and time constraints on changing to more sustainable land management.

5. Implement on-ground works
This included works such as tree planting, remnant vegetation protection, perennial pasture establishment and management, and improved management of discharge areas.

6. Work within an integrated framework
All activities which sought to increase linkages and compatibility with other organisations and programs worked towards achieving this goal.

7. Source Resources
Seek money and people.

We undertook a qualitative evaluation of the NESS because we sought to understand the logic of actions and human interactions within the program. Complex social issues such as these are best addressed by a qualitative approach (Morse & Richards 2002). Data creation and analysis followed Patton (1990), Dey (1993) and Silverman (2001). Our evaluation began with a review of regional, Victorian and Murray-Darling Basin salinity management documents. This was followed by semi-structured interviews with 20 stakeholders, and a focus group with landcare facilitators. The interviews and focus group were audio taped and then transcribed. Phrases in the transcribed notes were coded by evaluation topic. Similarly coded phrases were collated to identify themes in the data.

The information that follows is a distillation of comments made in program documents, the semi-structured interviews with stakeholders, and the landcare focus group. Some verbatim quotes, shown in italics, are provided from the interviews and focus group.

Box 2 Evaluation topics

GOALS/ACTIVITIES
Compatibly with social values and norms
Complexity
Targets setting
Encouragement
Promotion
Adoption theory
Compatibility with state/MDBC

LEARNING
Preparedness to learn
Alternative views
Scientific method
Local knowledge
Expert knowledge
Tolerance of failure
Adult education theory
Adaptive management
Reporting
Evaluation activities
Monitoring
Mapping
Modelling
Rewards/punishments

PEOPLE
Leadership
Citizen participation
Networks
Statutory and regulatory environment
Decision making

POWER
Agency support
Partnerships

INFORMATION
Technical information
Practical information
Local information
Communication
Storage
Capacity building- understanding
Awareness of issues

RESOURCES
Public funding/public costs
Capacity building- cost share
Commercial money
Trade-offs

IMPLEMENTATION
Plans/ strategies
Onground activities
Whole farm planning

RISK
Risk management

Social
Social impacts
Interest in issues
Equity

What we learned about the NESS implementation

The total budget for the five years of NESS implementation, including community contributions, was $1,545,340. The average full time equivalent staff available to implement the NESS program was 1.8. Much of the implementation of the NESS was directed towards developing a better understanding of salinity processes, raising community awareness of dryland salinity, achieving on-ground works such as establishing trees and perennial pastures, and sourcing resources for the program. Some resources were directed to the other goals, including seeking better understanding of management options, building skills and capacity for change, and working within an integrated framework. Limited resources hampered progress towards all goals, but particularly these latter ones. Our review concluded that the NESS had sound program logic, and was partially successful in working towards its goals. Details of NESS implementation outcomes, and our evaluation of them, are detailed in the report to the North East Catchment Management Authority (Allan & Curtis 2002).

Understanding adaptive management in the NESS

The NESS implementation program developed over time, and was responsive to new technical information and community concerns. Stakeholders recognised that the NESS could change as a more complete understanding of dryland salinity in their region developed.

> *We were really only operating under like best bet solutions I suppose, we just hoped we were doing the right thing, and we'll certainly be open to modifying the projects further on down if… the research does shows us different ways to go.*

However, such flexibility does not constitute active adaptive management. The NESS was a conventional program which used passive adaptive management. Decisions about research directions were unsystematic, there were missed opportunities for using implementation to enhance learning, and program evaluation was unstructured and undervalued. The three examples below illustrate these points.

No research framework

The development of a Research and Investigation strategy was recommended but not implemented. Instead, decisions about research activities were made in an unsystematic manner through the NESWG. While most of the investigations undertaken were useful, the absence of a research framework contributed to inefficiencies in the use of the information generated. For example, Electromagnetic Mapping (EM 31) was used early in the program implementation in response to pressure from landcare groups for information. The EM 31 mapping raised community interest in salinity, but there was limited follow-up from the NESS program as other activities vied for limited NESS resources. Without a research framework it was unclear what the EM investigations were trying to achieve, how the information could be used, and how it related to other information gathered through the NESS and elsewhere. This lack of clarity also led to some unfulfilled expectations within the farming community, and a subsequent disillusionment with investigations within the NESS program.

> *We did all the work with the electromagnetic surveying, and we really didn't get it interpreted properly, because I don't think they knew…I expected we would get more positive results than we got. They gave us maps…but it still didn't solve…*

Missed opportunities to learn

Despite little locally specific information about the efficacy of different salinity management options, no experimental field trials were established to assess recommended actions such as alley farming (incorporating trees within pastures) and tree planting to intercept ground water. One reason that trials were not established was the higher priority given to the implementation of on-ground works, including tree planting in various configurations at over 50 sites. Within an active adaptive management paradigm all of these could have been viewed as experimental treatments. However, only three of the areas treated as part of implementation had formal monitoring, and only one of these provided an example of learning from implementation. Alley farming was established on a sub-catchment scale, groundwater monitoring was established, bird inventories undertaken and interviews conducted with the landholder. The impetus for the monitoring was to enhance the demonstration value of the site, rather than to test the efficacy of the treatment. A second treated area also had groundwater monitoring established, but so many demonstration treatments were applied above the monitoring that it would be problematic to attribute discernible groundwater changes to any particular treatment.

The third area was part of the Victorian discharge mapping program, and had groundwater monitoring established, as well as an EM base map. The local landcare group had established trees and shrubs above the discharge site. They were also planning a number of new vegetation management activities around the discharge site, primarily for revegetation demonstration purposes. Unfortunately, planning for this later revegetation was carried out in isolation from planning for discharge monitoring.

> ***Interviewer:*** *...that's a CLPR monitoring site, so how have you linked with them?*
> ***Landcare member:*** *We haven't, well I suppose I'm hoping that [agency staff] is doing that link…*
> ***Interviewer:*** *So there wasn't any thought when you were doing that, that this is all being monitored, so this would be a chance to monitor* ?
> ***Landcare member:*** *To monitor the works? No, as far the hydrogeological thing goes…*

Together with the many unmonitored works, these examples represented a lost opportunity to learn more systematically from the implementation that was occurring.

Unsystematic evaluation

The NESS strategy document was not written in a way that facilitated evaluation. There was no statement of program objectives and many of the 56 recommended actions were unconnected, loosely defined and therefore difficult to evaluate. Prior to our review, formal evaluation of the program relied on reports from NESS staff to the various funding bodies and focussed on reporting the completion of proposed activities. These reports were closer to audits than evaluations, and did little to encourage reflection and learning from experience.

> *...the only things we really report on are the whether our dollars have been spent, and then on the hectares of revegetation, and hectares of perennial pastures, and discharge treatment, so that's the only formal information that sort of filters through up to the program.*

A five year review been recommended in the NESS document, but not necessarily with the intent of refining and improving the program. In the absence of an active adaptive management framework we could only look back at what had been undertaken in an attempt to identify what were largely unintended lessons.

Some factors constraining active adaptive management

A culture of reflection appeared to be absent from the NESS, inhibited by both institutional arrangements and social norms.

Institutional arrangements

As suggested, performance auditing and program evaluation are different. Performance audits evolved from financial audits, and are largely concerned with establishing efficiency. Program evaluation should be a more reflective process, and often focuses on obtaining information that can help stakeholders improve the outcomes of their programs (Patton 1990). As we have seen, most of the required

reporting for the fund providers of the NESS (and similar programs) fulfilled audit rather than evaluation requirements.

The nature, as well as the source, of the funding available to the NESS worked against fostering a culture of reflection. Funding was mostly short term (usually three years, but guaranteed for only one year at a time), tied to specific projects or expected outcomes, and often aimed at innovative or pilot programs.

> *...we need some continuing funding rather than this piecemeal every year put your hand out and they slap it a couple of times and then they, they give you some money. I think we need some sort of guarantee that we can continue*

> *They don't understand the time scale involved in this, if you expect any results in less than a decade you're just whistling Dixie. And that's been our problem, short term funding, limited you know, I won't say limited contracts, but limited times for programs and all this kind of stuff. Always got to have something new, not doing the same thing.*

> *The uncertainty of budgets and the uncertainty with, makes it very hard to build up a long term on going program when you don't, I mean we don't know what happens after the NHT after the um first of October, that's when all our, basically the salinity program cranks, grinds to a halt then… the multitude of agencies and programs and projects and reporting arrangements and structures and just such a complex maze to to work through, we just make it really difficult for ourselves*

Social norms

Research was separated from extension and on-ground works in the NESS document, and this carried over into program implementation. Research activities were managed by experts from the Centre for Land Protection Research (CLPR), and Goulburn Murray Water (GMW), while communication and implementation were the responsibility of the extension officers, landcare members and farmers. This approach reflects an increasing societal dependence on experts (Fischer 1990). Learning and implementation are seen as separate activities, to be assigned to different people, often in distinct organisations or divisions. An alternative approach, under an adaptive management paradigm, would be to cultivate a culture of reflection. This would encourage people to ask questions and test answers, rather than simply expert opinion. Such a culture would support each stakeholder's involvement as an active questioner and co-learner.

Another social factor that constrains an adaptive management approach is risk-averse behaviour. Many factors contribute to individual and community perception of and response to risk. One of these is confidence in institutions and the perceived credibility of the information they promulgate (Wildavsky & Dake 1990). Incomplete or conflicting information can create mistrust, because experts appear not to be expert (Finucane 2000).

The NESS took a landscape scale approach to managing dryland salinity. Because the landscape in question was predominantly private land, implementation relied on persuading landholders to undertake recommended works.

> *The single most important thing is to be able to assure the public, I think, that we're not guessing, in the causes of salinity, and therefore have the skill to target more specifically the areas that are causing salinity.*
>
> *We need to get smarter, from a scientific perspective, and try to fully understand or better understand what the processes are and where are the areas… I think there needs to be more science.*
>
> *The important thing is that you need to understand the processes involved so that you can identify what activity's required, and where it should occur to get the best outcome.*

As the quotes suggest, NESS stakeholders believed they needed to offer a degree of certainty based on rational science about the nature of the salinity problem and the efficacy of proposed ameliorative actions. The need for certainty inhibited questioning of the knowledge base underpinning recommendations and of the appropriateness of those recommendations. A reliance on technical knowledge devalued local or experiential knowledge. The emphasis on certainty and rationality constrained the emergence of a culture of reflection that would have supported fledgling attempts towards active adaptive management.

What would an active adaptive NESS look like?

We have established that the NESS did not apply an active adaptive management approach. What would such an approach to the NESS have involved? Using active adaptive management principles a hypothetical NESS management team would:

- Set out to use management to test hypotheses about the processes leading to dryland salinity in the region, and the efficacy of different management options. Either implementation would be designed to test these hypotheses, or opportunities for testing and learning would be sought during the inevitable patchy uptake of recommended actions.
- Develop an evaluation framework before implementation commenced. This would allow program reviewers to have a clearer understanding of issues most directly valued by the program stakeholders, rather than sifting through program evidence for lessons.
- Foster a culture of reflection throughout NESS, including an acknowledgment of the importance of evaluation in improving ongoing program delivery. Priority would be given to the formulation of stakeholder goals and there would be adequate resources for evaluation. Information management would be an important NESS activity.
- Accept uncertainty about the outcome of actions as a part of life for NESS stakeholders. Program "failures" would not be punished, as the information generated would recompense the resources invested in the attempt.
- Embrace all stakeholders in the culture of reflection. Demarcation between research and implementation would be reduced as lessons learned from doing were legitimised and welcomed.

Conclusion

Our evaluation of the NESS suggested that evolutionary and passive adaptive management was the preferred approach, even when a more active approach could have achieved better results. Many of the institutional and social barriers identified in the wider literature also impede more active adaptive management approaches to natural resource management in Australia. These are solid barriers, and we should expect natural resource managers to need significant support to address them. We have suggested that an actively adaptive management approach in the NESS would have included:

- hypothesis testing through planned or opportunistic implementation 'experiments'
- an evaluation framework which promoted reflection on and learning about the catchment as it was being managed
- adequate resources for monitoring and evaluation
- acknowledgment of uncertainty and risk, and
- blurring of distinctions between research and implementation

How then do we support active adaptive management at the regional scale?
Information is needed to:

- distinguish active adaptive management from other natural resource management approaches.
- underpin decisions about when adaptive management is an appropriate approach to pursue.
- develop programs that can get around the important social and institutional barriers to become genuinely and actively adaptive.

Examples of active adaptive management are scarce in Australia. The 2002 national adaptive management workshop at Lake Hume, near Albury (NSW) began to address these issues (Allan & Curtis 2003a; Allan & Curtis 2003b). One outcome of the workshop was the establishment of an adaptive management network. This network should become an important source of shared experience and information about all aspects of adaptive management.

Active adaptive management may have benefits for many Australian natural resource projects. Policy makers and managers need to recognise that active adaptive management is not the way they have always managed. By understanding the difference they will be better able to decide if and when to attempt active adaptive management.

References

Alexandra, J., Higgins, J. & White, T. 1998, *Environmental Indicators for National State of the Environment Reporting- Local and Community Uses*. Department of the Environment, Canberra. (State of the Environment (Environmental Indicator Reports)).

Allan, C. & Curtis, A. 2002, *A review of the North East Salinity Strategy and its implementation 1997-2001.* (Johnstone Centre Report: 170). Johnstone Centre, Charles Sturt University, Albury.

Allan, C. & Curtis, A. 2003a, *Notes From an Adaptive Management Workshop, Lake Hume, July 24/25 2002*. (Johnstone Centre Report 171). Johnstone Centre, Charles Sturt University, Albury.

Allan, C. & Curtis, A. 2003b, Learning to implement Adaptive Management. *Natural Resource Management,* **6**(1), pp 23-28.

Carpenter, S. R. 1998, The need for large-scale experiments to assess and predict the response of ecosystems to perturbation. In *Successes, Limitations, and Frontiers in Ecosystem Science.* eds M. L. Pace and P. M. Groffman. Springer - Verlag, New York.

Catchment and Water Division, DNRE 2000, *Draft Guidelines for the Review of Salinity Management Plans and the Preparation of Second Generation Salinity Management Plans*.

Clifton, C., Reid, M. & Ockenden, P. 2000, *Managing Dryland Salinity with Vegetation in North East Victoria.* Sinclair Knight Merz, Bendigo.

Curtis, A. and Van Nouhuys, M. 1999. Landcare Participation in Australia: the volunteer perspective. *Sustainable Development,* 7: 98-111.

Department of Conservation Forests and Lands. 1988, *Draft Regional Salinity Report: North East Region*. Salt Force

Dey, I. 1993, *Qualitative data analysis*. Routledge, New York.

Finucane, M. L. 2000, *Improving Quarantine Risk Communication : Understanding Public Risk Perceptions*. Decision Research, Eugene, Oregon. (00-7).

Fischer, F. 1990, *Technocracy and the Politics of Expertise.* Sage, Newbury Park, California.

Gunderson, L. 1999, Resilience, flexibility and adaptive management - - antidotes for spurious certitude? *Conservation Ecology* (online), **3**(1). http://www.consecol.org/vol3/iss1/art7 [Accessed 15 Mar. 2001].

Holling, C. S. 1978, *Adaptive environmental management and assessment.* Wiley, Chichester.

Holling, C. S. 1995, What barriers? What bridges? In *Barriers and bridges to the*

renewal of ecosystems and institutions. eds L. H. Gunderson, Holling C.S. & Light S.S. Columbia University Press, New York.

Johnson, B. L. 1999, The role of adaptive management as an operational approach for resource management agencies. *Conservation Ecology* (online), **3**(2). http://www.consecol.org/vol3/iss2/art8 [Accessed 15 Mar. 2001].

Lee, K. 1993a, Greed, Scale Mismatch and, Learning. *Ecological Applications,* **3**(4), pp. 560-564.

Lee, K. N. 1993b, *Compass and gyroscope: integrating science and politics for the environment*. Island Press, Washington DC.

Lumsden, D. & Reid, M. 1996, *Groundwater Trends and Salinity Risk in the North-East Region*. Department of Natural Resources and Environment, Centre for Land Protection and Research. (Technical Report No. 33).

Morse, J. M. & Richards, L. 2002, *Readme First for a User's Guide to Qualitative Methods*. Sage Publications, Thousand Oaks.

North East Catchment and Land Protection Board. 1997, *North East Regional Catchment Strategy.* North East Catchment and Land Protection Board, Wodonga, Vic.

North East Catchment Management Authority. 2001, *Annual Report 2001/2001*. North East Catchment Management Authority

North East Salinity Working Group. 1997, *Reversing the Trend: North East Salinity Strategy (Draft)*. Department of Natural Resources and Environment, Wangaratta.

Patton, M. Q. 1990, *Qualitative evaluation and research methods.* Sage Publications, Newbury Park.

Reid, M. & Cheng, X. 2001, *North East Region Groundwater Observation Bore Census and Monitoring Review*. Department of Natural Resources and Environment, Bendigo. (Monitoring Report No. 27).

Roe, E. 1996, Why Ecosystem Management Can't Work Without Social Science: An example from the Californian Northern Spotted Owl Controversy. *Environmental Management,* **20** (5), pp. 667-674.

Silverman, D. 2001, *Interpreting Qualitative Data: Methods for analysing talk, text and interaction.* 2nd edn. Sage Publications, London.

Walters, C. J. & Green, R. 1997, Valuation of experimental management options for ecological systems. *Journal of Wildlife Management,* **61**(4), pp.987-1006.

Walters, C. J. & Holling, C. S. 1990, Large-scale management experiments and learning by doing. *Ecology,* **71**(6), pp. 2060-2068.

Wildavsky, A. & Dake, K. 1990, Theories of Risk Perception: Who Fears What and Why? *Daedalus,* **119**(4), pp.41-60.