

Erratum

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The Millennium Assessment

FRED POWLEDGE

Charged with describing the current state of the environment, scientists worldwide collaborated to produce the Millennium Ecosystem Assessment. In seven synthesis reports and other technical documents, the assessment summarizes the Earth's present condition and the impacts humans have on critical ecosystem services.

On 5 June 1992, governmental representatives from 157 nations, meeting in Rio de Janeiro at what was popularly called the Earth Summit, promised to work harder at protecting the environment. Among many other things, they deplored the “general lack of information and knowledge regarding biological diversity” and spoke of “the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures.” They would establish a multidisciplinary subsidiary body to furnish the signatories with “timely advice” and to identify “innovative, efficient and state-of-the-art technologies and know-how relating to the conservation and sustainable use of biological diversity.”

Now the Convention on Biological Diversity and its sister international environmental conventions have received that advice and know-how. In March 2005, the Millennium Ecosystem Assessment, a body created by the United Nations (UN) and other organizations, began releasing the results of four years of study by over a thousand researchers.

The project was budgeted at \$24 million and will most likely generate useful information for a long time. Perhaps even better, it may serve as a valuable benchmark for future assessments.

For all its thoroughness, the MA (as its authors refer to it) deliberately refrains from offering prescriptions for getting out of Earth's environmental dilemma—an omission that might confound some veteran report readers. The MA does provide chapter and verse on the decline of the planet's ecosystem services. Its most compelling comment is that 60 percent of the 24 ecosystem services it examined are being degraded, largely through human activity. But it does not trot out a list of suggested fixes. For that reason (and because the MA spent most of its money on the assessment and little on public relations), the release of the assessment—seven synthesis reports and four thick technical volumes and numerous subsidiary documents—was not viewed by most media as earthshaking news. The *New York Times* carried the initial announcement in an ordinary wire service story, and an abbreviated one at that.

The report

The MA authors made no apologies for their reporting method. Like its widely known and celebrated predecessor, the Intergovernmental Panel on Climate Change, the MA would present analysis, not remedies. (The overarching remedy is apparent, however: Accept, understand, and protect the value of ecosystems for the many essential services they provide.) “The purpose of a scientific assessment,” the authors explain, “is not to assume a decision-making role by actually selecting the most appropriate option, but rather to contribute to the decision-makers' understanding of the scientific underpinning and implications of various decisions.”

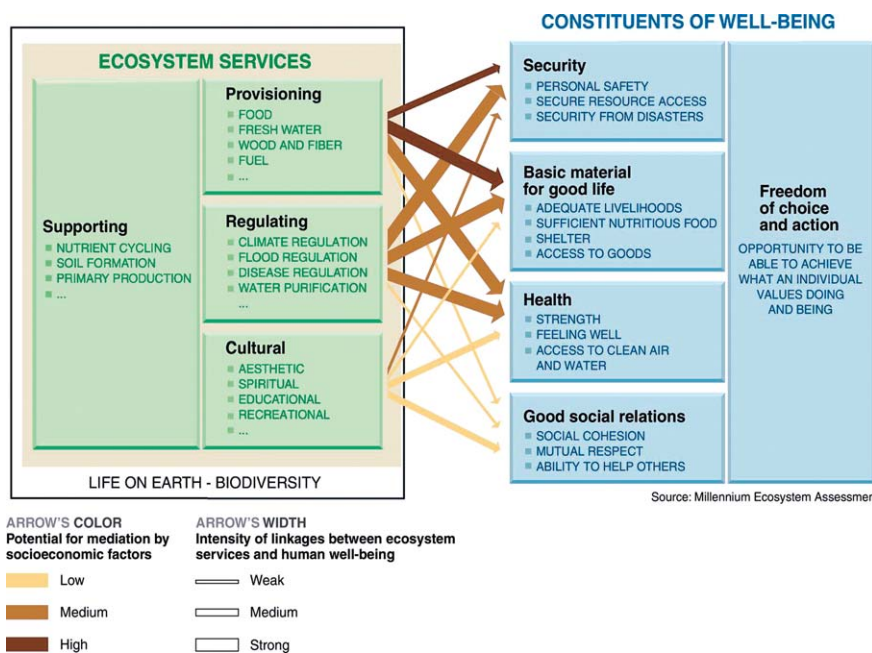
The MA's reports (available online at www.millenniumassessment.org and in printed form from Island Press) never lose view of a few fundamental assumptions: One is the notion that there are powerful, complex linkages between ecosystem change and human well-being. The other is that ecosystem services, which the MA defines as “the benefits people obtain from ecosystems,” offer a good means for measuring Earth's con-

dition. “By examining the environment through the framework of ecosystem services,” says an early MA document, “it becomes much easier to identify how changes in ecosystems influence human well-being and to provide information in a form that decision-makers can weigh alongside other social and economic information.” The MA thus determinedly establishes that its report will not be another celebration of birds and bunnies at the expense of humans. The MA comes down firmly in favor of appreciating the importance of humans and their needs.

But it also explains in great detail the havoc that humans have wreaked in their efforts to satisfy those needs. Rapidly growing human demands for fresh water, food, fuel, timber, and fiber have brought about “a substantial and largely irreversible loss in the diversity of life on Earth,” says the report. The planet’s continued sustainability no longer can be taken for granted. Fisheries, land, biodiversity, and species are all in dangerous decline.

The focus on human involvement is clear in the MA’s choices of major components of its assessment: human health, desertification and land degradation, global warming and climate change, population, and wetlands and water. Another prominently featured MA investigation concerns business and industry, which both use ecosystem services and are big contributors to ecosystem change.

Throughout its report, the MA emphasizes the point that protecting ecosystem services is good for business. By adjusting to the new operating environment imposed by changing ecosystem services, businesses can help themselves and the environment. Some interpretations of the MA seemed to miss this point. One online account, says MA director Walter V. Reid, claimed the report “was going back to traditional views that there’s a fundamental trade-off between the development and environment—which was precisely what we had not said.” And *The Economist*, not known for its environmentalist leanings, “portrayed the Millennium Assessment as saying that markets would save the world—which we didn’t actually say.”



This schematic shows the Millennium Ecosystem Assessment’s (MA’s) view of major linkages among categories of ecosystem services and components of human well-being. The graphic also examines possibilities that socioeconomic factors (the brown and yellow arrows) can affect the linkages. The services–well-being matrix is basic to the assessment and is examined at length in the MA reports.

Source: Millennium Ecosystem Assessment.



Walter V. Reid was director of the Millennium Ecosystem Assessment.

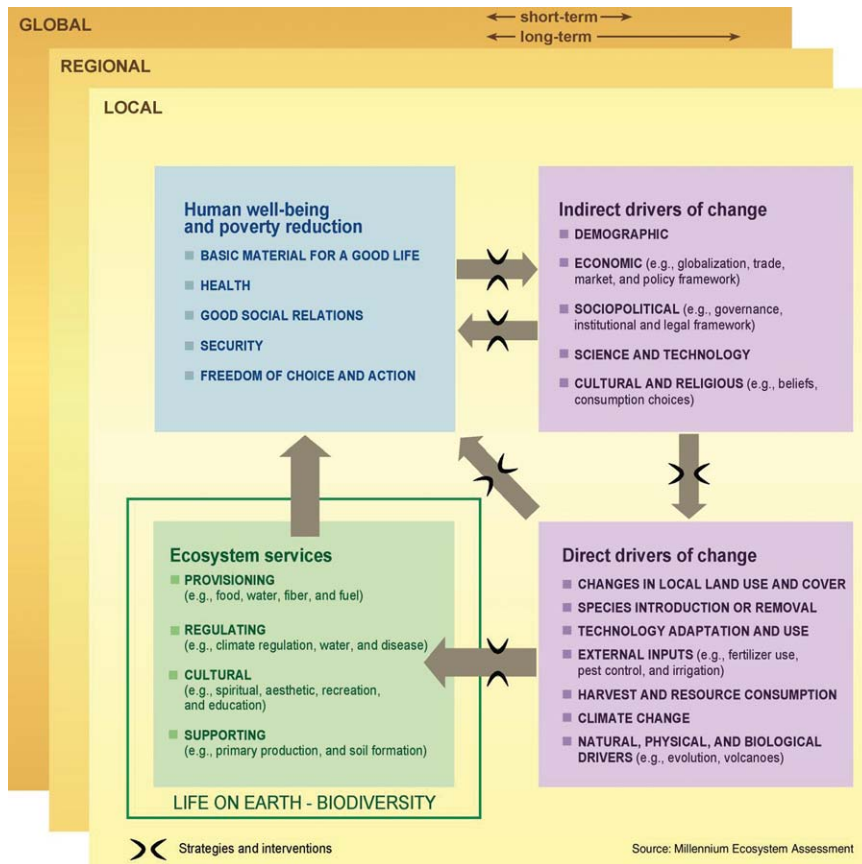
Reid, a consulting professor at the Stanford Institute for the Environment, coordinated a team of more than 1300 scientists and reviewers over the four-year life of the project. Photograph courtesy of IISD/Earth Negotiations Bulletin.

The MA employs a couple of organizing principles that are infrequently used in such gargantuan reporting jobs. One involves assembling a very large group of scholars, some 1360 of them

from 95 countries, to gather the information, write the report, and review what one another had written. Since the health of the world’s ecosystems has a disproportionate effect on the less-well-off world, a great number of the MA’s staffers came from developing countries. (Early on in the assessment’s planning stages, says Reid, its authors realized that the planned global appraisal would not be enough; subglobal assessments were added to the mix, as were representatives of indigenous groups from around the world.)

The MA established a secretariat in Kuala Lumpur, Malaysia, at the WorldFish Center (a component of the Consultative Group on International Agricultural Research, or CGIAR, one of the MA’s sponsors), but the bulk of the international effort was done with the modern tools of Internet and e-mail—and, indeed, probably could not have been done in any other way.

Another noteworthy feature of the assessment is its use of a conceptual framework that is far more extensive than those of other environmental studies.



Harold A. Mooney, Stanford University professor of environmental biology, was cochair (with Angela Cropper) of the Millennium Ecosystem Assessment’s assessment panel, as well as a leading member of the core writing team. He described the report’s conclusions as “not comforting,” but added that it contained a great number of potential responses to the global environmental dilemma. Photograph courtesy of IISD/Earth Negotiations Bulletin.

The foundation of the Millennium Ecosystem Assessment (MA)—and the quality that makes the MA unusual among environmental assessments—is its conceptual framework, which investigates interactions among biodiversity, ecosystem services, human well-being, and drivers of change. In the MA’s view, indirect drivers that affect biodiversity (upper right) can cause direct changes (lower right), which in turn can affect ecosystem services (lower left), thus influencing human well-being and efforts to reduce poverty (upper left). The flow of drivers is complicated by the fact that they can take place at multiple scales and can cross scales. Strategies and interventions (see the arrows) can occur at many places. Source: Millennium Ecosystem Assessment.

The MA’s analysis, according to its report, “places human well-being as the central focus for assessment,” while recognizing that ecosystems and biodiversity have intrinsic values. In the model (see the graphic above), changes in the human condition drive ecosystem changes, which then affect ecosystem services, causing them to further change, for better or worse, and then the cycle continues. But the complexity doesn’t stop there. The changes occur at different scales—global, regional, local—and can cross scales. Humans, led by the decisionmakers among them, can respond to these changes, negatively and positively, and can thus help control their ecological future.

The MA also emphasizes the importance of environmental accounting, or the need to recognize the value of all of nature’s services, not just those that can be measured in instant dollars. Such accounting is necessary for a proper understanding of ecosystem services. In a paper written by Reid, World Bank scientist Robert Watson, and Stanford professor Harold A. Mooney, the MA leadership argued that, while different societies value such services as water and forests in different ways, “decision-makers should make sure the value of all ecosystem services—not just those bought and sold on the market—[is] taken into account when making decisions.”

The assessment burrows further into ecosystem alteration, and its effects on human well-being, by developing four scenarios to probe humans’ potential ways of dealing with change (see the sidebar “Four scenarios” on the next page). Interestingly, none of the scenarios represents the “business as usual” approach that is often a component in such analyses.

Scenario development, says the MA, “is a way to explore possibilities for the future that cannot be predicted by extrapolation of past and current trends.” None of the four projections, the authors allow, “represents an optimal outcome. A selected mix of policies from several scenarios may yield better outcomes than any single scenario.” In any event, improvement would require big changes in policy, such as major investments in poverty reduction and education and elimination of harmful trade barriers and subsidies.

The effect and the follow-up

What has been the effect of this massive effort? “The ultimate impact of the MA,”

the assessment's organizers concluded as they finished their work, "will depend on the extent to which the MA findings are used by decision makers," both at global and smaller scales. They also expressed hope that other institutions would use the MA's conceptual framework and other innovations in continuing assessments.

Reid, who is a consulting professor at the Stanford Institute for the Environment, feels that media reaction to the report was "very mixed." It was extensive in Europe's print and broadcast media, minuscule in North America. It was "hugely influential" in the ongoing work of the Convention on Biological Diversity and other international convention bodies,

Reid says. (These include most prominently the UN Convention to Combat Desertification and the Ramsar Convention on Wetlands.) Perhaps significantly, Reid notes in a survey issued a year after the assessment was released, "There appears to have been no impact at all within the Bretton Woods Institutions [World Bank, International Monetary Fund, and other international groups]." Watson, who is chief scientist for the World Bank, the best known of those institutions, served as cochair of the MA board.

Despite the unevenness of media reaction to the report, abundant word did get out. A year of daily searches for "Millennium Ecosystem Assessment" on



Angela Cropper, Millennium Ecosystem Assessment board member and cochair of its important assessment panel, is cofounder and president of the Cropper Foundation of Trinidad and Tobago. The foundation promotes sustainable Caribbean development, in its words, "across a range of disciplines and sectors." Its project "Community Component of an Assessment of the Northern Range of Trinidad" is one of the MA's subglobal components. Photograph courtesy of IISD/Earth Negotiations Bulletin.

Four scenarios

The Millennium Ecosystem Assessment developed four scenarios—"plausible, challenging, and relevant sets of stories about how the future might unfold." The four scenarios were described in a 500-plus-page volume of MA reports. Here are some excerpts:

Global Orchestration scenario

Authors of this scenario envision "a worldwide connected society in which global markets are well-developed. Supra-national institutions are well placed to deal with global environmental problems, such as climate change and fisheries." But "their reactive approach to ecosystem management makes them vulnerable to surprises arising from delayed action or unexpected regional changes."

Order from Strength scenario

The world, according to this scenario, is fragmented and regionalized, "concerned with security and protection, emphasizing primarily regional markets, and paying little attention to the common goods, and with an individualistic attitude toward ecosystem management." Nations look after their own interests. People "see the environment as secondary to their other challenges. They believe in the ability of humans to bring technological innovations to bear as solutions to environmental challenges after these challenges emerge." (The scenarios working group was unanimous in calling the Order from Strength scenario "unsustainable and ultimately disastrous in terms of ecosystems and the societies they support.")

Adapting Mosaic scenario

"Discredited global institutions" result in a scenario in which local ecosystem strategies and institutions are important. "Investments in human and social capital are geared toward improving knowledge about ecosystem functioning and management, resulting in a better understanding of the importance of resilience, fragility, and local flexibility of ecosystems." With the resulting diversity of local approaches, global environmental problems (such as climate change) may be untended, "and global environmental surprises become common."

TechnoGarden scenario

This scenario offers "a globally connected world relying strongly on technology and on highly managed and often-engineered ecosystems to deliver needed goods and services." This approach brings benefits, often of global size, but it also reveals "the risks inherent in large-scale human-made solutions."

major Internet sources resulted in hundreds of articles and comments. They included these:

- An International Biodiversity Day column in *The Hindu* measured India's environmental progress against the assessment's findings.
- A column in a Taiwan newspaper linked the MA figures with an attack on President George W. Bush for "eviscerating the Endangered Species Act."
- Traci Hukill, a journalist from California, called the report a candidate for "the world's most underappreciated eco-study" and "definitely the most unevenly appreciated one."
- The *Financial Times* of London published a letter arguing that the assessment "should be compulsory reading for governments, citizens, and business everywhere."

The decisionmakers

Reid and other MA principals wish they could have invested more money in presenting their report to the public at large, but their first loyalty was to the decisionmakers who would, they hoped, use and adapt their product. At the top of their list were the global convention organizations, national institutions, nongovernmental organizations, and the business world.

Among national governments, says Reid, the success has been mixed. Several African nations are using MA techniques in their own ecosystem assessments. The Netherlands, Ireland, and Sweden are also using the MA. But when Reid inquired about the assessment's impact in India, the reply was "no obvious impact." There was similar disappointment in Argentina.

One big hope is the People's Republic of China. The republic's Ministry of Science and Technology has announced that the nation (which has conducted its own subglobal, regional assessment) will launch a four-year-long national ecosystem assessment modeled on the MA. "This, to us, is what needs to happen for countries to do anything," says Reid. "The global findings are valuable in identifying the importance of the issue, and of global problems. But they don't give the national decisionmakers any guidance. That person needs to know specifically what the trade-offs are [among ecosystem components] in their country. So an assessment in China would be exactly what we would like to see as a follow-on activity. It has a sixth of the world's population, and that would be a pretty good follow-up."

Within the private sector, the MA so far has one prominent example. The investment firm Goldman Sachs, a major owner-operator of power plants that burn fossil fuels, has pledged its commitment to the MA principles. At the base of Goldman Sachs's policy is a recognition that climate change and economic growth are linked.

At the White House level, the United States has shown little interest in the UN-sponsored assessment. But Reid notes that at other, working levels—for example, the science advisory board of the



A. H. Zakri was cochair (with Robert T. Watson, chief scientist of the World Bank) of the Millennium Ecosystem Assessment. Zakri, director of the United Nations University Institute of Advanced Studies, is a native of Malaysia, where the MA secretariat had its headquarters. Zakri, who has held many positions in global environmental institutions, was a member of the Malaysian government delegation to the 1992 Convention on Biological Diversity. Photograph courtesy of IISD/Earth Negotiations Bulletin.

Environmental Protection Agency—there is keen interest in, and incorporation of, the MA.

The assessment has been used in myriad other ways. Academics, many of whom were among the report's 1360 authors, are using the MA in their classes, journal articles, research projects, and other writings. The assessment's conceptual framework and use of scenarios have been widely used and adapted. Says Stephen B. Carpenter, University of Wisconsin limnologist, prominent member of the MA assessment panel, and prolific author of journal and other articles on the assessment: "The MA has had a huge impact on the assessment community and the science community." An example, he says, would be the "clever innovations" that "are influencing the ongoing science of modelling ecosystem services."

Subglobal assessments and other next steps

Twenty-nine subglobal assessments were planned to accompany the MA. They range from examinations of the Stock-

Earth a star?

Fredrik Moberg is editor of *Sustainable Development Update*, a periodical published by the independent, nonprofit Swedish organization Albaeco. In his publication and an e-mail interview, he discussed the assessment's mixed results, from "great success" to "zero impact on policy."

In an early look at the assessment, Moberg wrote that "the unique thing about the MA is that it states the obvious in ways that make the emperors of the world listen." A year after the report's release, he was asked if the emperors were really paying attention.

"Maybe it's simply too early to say if the world's policy makers have listened or not," he replied. "These kinds of changes take time. It's more or less a change in world view...that is required if policy is to be adjusted according to the MA findings—findings that healthy ecosystems are often worth more to society than ecosystems optimized for production of one or a few goods and services....There are real signs of changes in policy in some countries, but in others the judgment that it has had 'zero impact on policy' seems rather fair." But by no means, he said, should the work of the MA end now. "The real work starts now."

While the degradation of Earth's ecosystems is increasingly being felt, it's mostly felt by "the poor and marginalized," said Moberg. "Unfortunately, it's not until a catastrophe happens that it turns into news. And it should happen in your own back yard."

Perhaps, though, he added, the unexpected success of a motion picture about ecosystem collapse—Al Gore's *An Inconvenient Truth*—may make a difference. "Maybe something will happen," said Moberg, "now that the planet has become a movie star. Maybe the rich parts of the world will finally listen?"

holm urban region to the coastal, small island, and coral reef ecosystems of Papua New Guinea; to people and the environment in the Philippines; to the downstream Mekong River wetlands ecosystem in Vietnam.

Some of the smaller assessments are still in preparation; some didn't happen. An example of the latter comes from Norway, where in 2002 the government's Environmental Information and Monitoring Department commissioned a pilot study of a proposed full-scale Norwegian Millennium Ecosystem Assessment. The planning document was quite thorough, promising linkages to other environmental projects in Norway, other Nordic countries, and the world. But the larger study never materialized. An official said, though, that the Norwegian government is exploring ways to use MA tools in its national policies and strategies.

The assessment fared better at the Nairobi-based Alternatives to Slash and Burn (ASB) program, a CGIAR component. Sandra Velarde Pajares, acting global coordinator of the agroforestry program, says that the program's association with MA added a "new dimension to ASB's research agenda, mainly the use of participatory scenarios." Because of the MA, she says, her program has expanded its efforts to influence decisionmakers.

Many large environmental assessments end up gathering dust on bookshelves. The MA's creators are determined not to let that happen with their report. They

Visit these Web sites for more information:

- www.millenniumassessment.org
- www.wri.org
- www.biodiv.org
- www.cgiar.org
- www.worldfishcenter.org

hope that a number of next steps will further augment the usefulness of their effort.

The Washington-based World Resources Institute (WRI), a prominent player in MA's creation, has begun a project named "Turning the Millennium Ecosystem Assessment into Action" that, among other things, devises ways to better inform policymakers. WRI also plans to produce a methodologies manual for developing countries that want to integrate their ecosystem management and development decisions.

David Suzuki, a scientist and broadcaster (and member of the MA board of directors), thinks of the assessment as a necessary first step. "It has created a baseline for us to measure successes and failures of future policies and actions," he summarizes in an MA paper. "It has given us a snapshot of where we are and where we are headed if we do not start making changes soon."

Speaking of baselines, Stephen Carpenter says the MA has "revealed some enormous gaps in basic knowledge" that

now need to be filled. "The world needs a good stock-taking of ecosystem services every few years," he says. "No one would run a corporation without periodic assessments of the status, trends, and future of the life support system."

Next steps are very much on the mind of Walter Reid. "We assembled and archived the data in a way that a future assessment could look back on this," he says. He hopes to assemble the assessment's sponsors soon to evaluate the project's impact—"and use that as a basis for a discussion of whether an assessment process like this be repeated. The plain truth is that these assessments are by far the most valuable if they are repeated."

Reid acknowledges that the Millennium Ecosystem Assessment could hardly have been done 10 years ago. The lack of data and communications would have severely restrained any such effort. "And even five years ago it would have been semichallenging to do.

"But that said, it still wasn't easy. We were somewhat surprised at how limited the data were. There are lots of data on the environment and lots of data on people, but when it comes to looking at the links between the environment and people, that's not the way people have gathered data and not the way they've studied them. It was incredibly frustrating."

Fred Powledge (e-mail: fredpowledge@nasw.org) is a science writer based in Hollywood, Maryland.

Erratum

The wrong graphic appeared as figure 1 in the article by Tamás Székely and colleagues in the printed October issue of *BioScience* (vol. 56, p. 802). We regret the error. The correct figure is below.

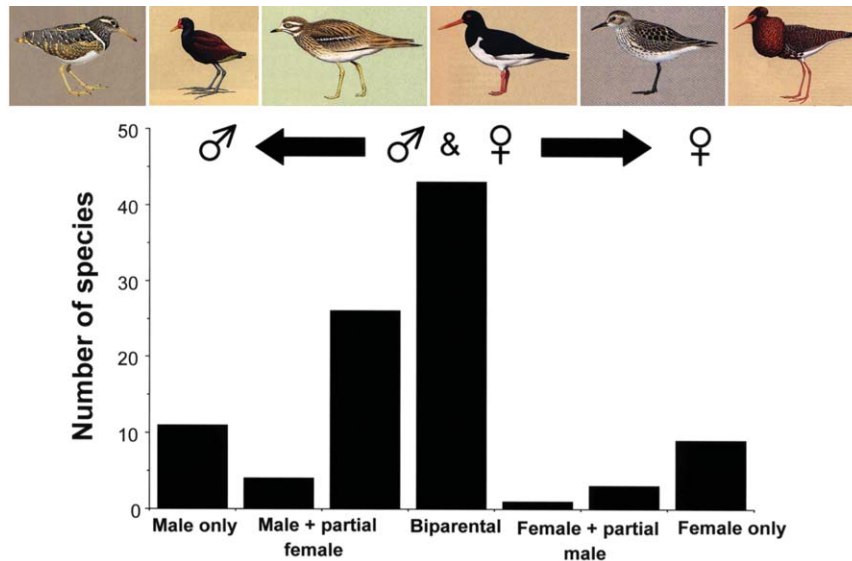


Figure 1. Distribution of parental care in shorebirds. Male-only care is often associated with polyandrous mating systems, whereas female-only care is associated with polygyny and leks (modified from Székely and Reynolds 1995). The species pictured above the graph are, from left to right, the greater painted snipe (*Rostratula benghalensis*), wattled jacana (*Jacana jacana*), Eurasian thick-knee (*Burhinus oedicephalus*), Eurasian oystercatcher (*Haematopus ostralegus*), white-rumped sandpiper (*Calidris fuscicollis*), and ruff (*Philomachus pugnax*); photographs are from del Hoyo and colleagues (1996).

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