

INTEGRAL ADAPTATION TO CLIMATE CHANGE

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ABSTRACT In this article, we discuss the limitations of current approaches to climate change adaptation, which focus predominantly on sectoral and technological approaches and reflect objective, third-person analyses. We then consider how Integral Theory can contribute to new understandings of adaptation by making room for many disciplines, perspectives, and validity claims. In particular, we focus on the benefits of integrating interiority and greater attention to worldviews, awareness, and motivation in adaptation research and policies. We describe what “integral adaptation” might look like in practice. We conclude that integral adaptation to climate change involves a radical transformation of the way that we think about change, from something that humans simply respond to and objectively manage, to something that humans consciously create.

KEY WORDS: adaptation; conservation; Integral Theory; technology; transdisciplinary research

Climate change is one of the most challenging and complex problems facing humanity, and it is likely to have significant consequences for human development and human security (IPCC, 2007a, 2007b; UNDP, 2008; Leichenko & O'Brien, 2008; Matthews et al., 2010). Although measures to reduce greenhouse gas emissions can significantly influence the rate and magnitude of future climate change, it is increasingly recognized that society will have to adapt to some climate change over the coming decades, regardless of mitigation efforts. In fact, many scientists are projecting temperature increases of up to 4 degrees Celsius by the end of the century, regardless of emissions reductions (Parry et al., 2009; Lovelock, 2009). As Parry and colleagues (2008) note, “even with an 80 percent emissions cut, damages will be large...Residual damage will be great unless we invest in adaptation” (p. 69).

The complexity of climate change requires developing and implementing a sufficiently complex response at all scales, from the international, to the national, to the community, and down to the household and individual levels. Efforts to adapt to the impacts of inevitable climatic changes, while at the same time drastically reducing greenhouse gas emissions, will require transformations at a rate and scale that is unprecedented in human history (Adger et al., 2009; Orlove, 2009). The challenges of climate change adaptation and mitigation require societies to adapt to not only new biophysical conditions, but also to new understandings of human-environment relationships. For example, the very idea that humans are changing the climate system can be considered a radical belief that challenges many existing worldviews—not only magical, mythical,

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and traditional worldviews that attribute weather events to larger, supernatural, or external forces, but also rational worldviews that see nature as separate and distinct from humans (i.e., as something that can be both exploited and managed). Thus from a broader perspective, adaptation is not simply about the changes in systems and behaviors required to reduce the negative impacts of climate change, but about the wider capacity of individuals and societies to respond to challenges to existing beliefs, values, and worldviews. This wider interpretation calls for a more integral approach to adaptation; one that includes both objective and subjective dimensions of adaptation, and can inform both climate change adaptation theory and practice.

Integral Theory offers an innovative framework that can contribute to the process of adaptation. Integral Theory's rigor, inclusivity, breadth, and depth offer a promising way forward to addressing complex issues (Wilber, 2000; Esbjörn-Hargens, 2006; Hochachka, 2008). An integral approach has been applied to many complex challenges, such as forest conservation in the Peruvian Amazon (Hochachka, 2009); leadership development for sustainability in sub-Saharan Africa (One Sky, 2009); leadership development and community capacity enhancement in relation to HIV/AIDS in 40 countries (Diouf et al., 2005); organizational development (McLaren & Kelleher, 2005); and community development in El Salvador (Hochachka, 2005, 2008). An integral approach to adaptation recognizes that adaptation cannot be solely conceptualized or engaged as behavioral and systemic changes. It must also include interior changes, both personally and culturally. Adaptation involves a changed sense of self, not as a passive subject to shifts in the climate system that are outside of one's control, but as an active player in the future of the community and world—all of which relate to worldviews, values, beliefs, and self-definitions. This includes individuals' personal capacities to be creative and innovative by thinking outside the box, to be reflective yet action-oriented as leaders, and to be internally resilient in the face of disruptive change. Invoking multiple scales, an integral approach also includes the cultural dimension of adaptation, such as the capacity of groups to peacefully negotiate responses in turbulent times (e.g., through periods of unpredictable weather events and financial instability), to undertake collaborative action in spite of conflicting values and beliefs, and to take into consideration the ethics of greenhouse gas emissions reductions (e.g., cultures with the smallest carbon-emission footprints are often the most vulnerable to the impacts of climate change).

In this article, we discuss how Integral Theory can contribute to a wider and deeper understanding of adaptation to the unprecedented challenges of climate change. First, we discuss the limitations of contemporary approaches to climate change adaptation, and in particular how a predominantly sectoral and technological focus tends to exclude important perspectives. Next, we present Integral Theory and the AQAL framework, and discuss how it can contribute to a new understanding of adaptation by making room for many disciplines, perspectives, validity claims, and worldviews. Using an Integral framework, we describe what "integral adaptation" might look like in practice. From an integral perspective, adaptation is unlikely to manifest as a simple, linear process; changing beliefs and worldviews can potentially lead to dramatic transformations in systems, behaviors, cultures, and experiences. We conclude that integral adaptation to climate change involves a radical transformation of the way that we think about change, from something that humans simply respond to and objectively manage, to something that humans can consciously create.

Contemporary Approaches to Adaptation

In general terms, to adapt can be described as "to become adjusted to new conditions" (*Oxford English*

Dictionary, 2002). In relation to climate change, adaptation is defined by the IPCC (2001) as “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (p. 982). This latter definition presupposes that climate change is the driver of new conditions, and that responses or adjustments are directly related to the *impacts* of climate change (i.e., warmer temperatures, changing precipitation patterns, sea level rise, melting glaciers, and so on). Many adaptive responses have been identified accordingly. Examples include sea walls to protect against storm surges; drought-tolerant seeds and efficient irrigation systems to respond to water scarcity; improved early warning systems to alert populations to potential climate-related hazards; and changes in governance structures to handle inter-basin water disputes (Adger et al., 2007).

Sectoral and technological approaches clearly have an important role to play in climate change adaptation. By addressing specific climate impacts (often identified based on current climate variability or climate model scenarios or projections), these adaptations can indeed reduce vulnerability. Such approaches often emanate from a rational and disciplinary perspective. Yet responses developed within disciplinary “silos” often end up producing piecemeal solutions—solutions that address specific outcomes, but are blind to other equally important areas. For example, planting drought-tolerant crops as an adaptation to increasing water deficits may address food production goals, yet at the same time it may ignore behavioral practices and cultural priorities. In other words, across the emerging field of climate change adaptation, discussions and debates rarely address the full complexity of the challenge, such as ecosystem dynamics, economic and social relations, governance, behavioral changes, *and* values, worldviews, and cultural norms (O’Brien, in press).

Furthermore, little attention has been paid to understanding how adaptation can be realized in practice, including how interior adaptive capacity can be both developed and enacted. The adage “You can bring a horse to water but you can’t make him drink” is apt to climate change adaptation: no matter how excellent the technologies and systemic changes are, they will be of little use to people and communities who do not understand how to use them, or do not feel motivated to do so. Cultural interpretations of climate change adaptation have, for example, not been included in the scientific discourse of the IPCC (IPCC, 2007b; see Orlove, 2009; Hulme, 2009). This partial and fragmented approach to adaptation is alarming, given the urgency of climate change and the need to move from theory to practice.

Before we discuss the AQAL framework and its relevance to adaptation, we summarize three central issues facing the field of climate change adaptation. Firstly, while the call for more comprehensive approaches to adaptation is increasingly visible in the discourse, particularly around transcending distinctions between development and adaptation, or between environmental concerns and economic issues, in practice few integrative frameworks exist to support this adequately and rigorously (Osman, 2006; Leichenko & O’Brien, 2008). Many agree that a complex issue such as climate change demands an interdisciplinary approach, yet most frameworks are based on differing conceptual models and chains of causality (Newell et al., 2005). Integrated assessment models (see, for example, Bouwman et al., 2006) take up this challenge, yet rarely account for all perspectives and the relationships between subjective and objective perspectives.

Secondly, perhaps because climate change was first studied, diagnosed, and understood by physical scientists, most knowledge about it resides in objective, third-person analyses. Yet climate change is a complex, abstract, non-linear process that is not easy to grasp or respond to, and people make meaning of it in varied

ways. This domain of individual and collective interiority, including mental models, values, understandings, and social discourses, is incredibly important for understanding the climate change issue, both in terms of extending concern or care in regard to the issue and for being motivated to take action. The subjective, interior dimensions, which are often left out of contemporary approaches to adaptation, can be seen as a necessary complement to objective research and actions taken in response to climate change.

Thirdly, the need for building the capacity of both leaders and practitioners to work with the interior dimensions of adaptation is becoming increasingly evident. Relating climate change adaptation to the needs, goals, motivations, and aspirations of different individuals and groups requires leaders that can take multiple perspectives, and skilled practitioners that have an understanding of human development as well as environmental change processes. As Balgis Osman Elasha (2006) explains:

The teams charged with assessing climate change vulnerability within their countries and considering adaptation options...have tended to be composed of physical, more than social scientists, and as a result are less likely to have strong inherent skills in the type of community-based assessment [required]. (p. xiii)

To summarize, some of the critical issues facing the field of adaptation include: 1) the need for a rigorous integrative framework that brings together multiple perspectives and approaches to adaptation; 2) the need to integrate individual and collective interiority with biophysical, scientific, and technological approaches involved in climate change adaptation; and 3) the need for capacity building among leaders and practitioners to carry this forward. We argue in the next section that Integral Theory can provide both a framework and tools for moving forward in both adaptation research and practice.

Integral Theory and Adaptation

Integral Theory discloses four domains of reality that are important to acknowledge and include in any adaptation intervention. These irreducible domains of reality or perspectives, depicted as four quadrants, draw from different methodologies, each with their own particular validity claims (Fig. 1). The four perspectives (subjective, intersubjective, objective, and interobjective) recognize that phenomena can be seen in different ways: from an inside or an outside perspective, and from a singular or plural perspective (Wilber, 2006; Esbjörn-Hargens, 2009). Integral Theory points to the need to include all four perspectives in both theoretical and practical approaches to adaptation, and to consider different levels of consciousness or awareness and worldviews among those undertaking adaptations. The framework captures different dimensions of reality, which together provide a more comprehensive and inclusive understanding of both problems and solutions. Integral Theory recognizes both interiors and exteriors, with interiors referring to the subjectivity and intentionality of individuals and exteriors referring to behaviors and physiological characteristics in the singular, and to cultural (interior) and systems (exterior) phenomena in the plural. It also recognizes different states and stages of consciousness as well as the role of psychological shadow elements (e.g., projection and denial) (Wilber, 2006).

Importantly, Integral Theory recognizes that no reality can be assessed based on only one set of validity claims. For example, changes in adaptive capacity cannot be measured only by interior validity claims (e.g.,

asking how one feels), or only by exterior validity claims (e.g., measuring what one does), but rather is best assessed by including diverse sets of indicators and measurement methods. An Integral approach draws on multiple validity claims from all quadrants; since each quadrant derives evidence from different data using different methods, it can provide a more complete understanding of adaptation. This represents a more comprehensive way to promote and develop successful responses to climate change.

The Integral model provides a way to include all quadrants—all four domains of reality, their methodologies and validity claims—in any adaptation strategy. While there are numerous calls for interdisciplinary research and actions, the lack of a framework remains a barrier to bringing disciplines together into meaningful dialogue. Integral Theory integrates disciplines by including and transcending them. That is, it “hovers” above conventional disciplines, providing a map for understanding how they relate to and influence each other. The



Figure 1. The Integral framework’s four domains of reality, with validity claims related to adaptation.

Integral framework is perhaps better described as a *transdisciplinary* framework that serves to integrate each discipline or approach into a larger picture, rather than as a multi- or interdisciplinary framework that brings different disciplines together, without necessarily accounting for the synergies between perspectives and domains of reality. The implicit preferences associated with multi- and interdisciplinary frameworks may exclude perspectives that are important in identifying appropriate adaptation measures, strategies, and actions. Below, two important insights from Integral Theory are discussed in relation to the field of climate change adaptation, namely, its ability to meaningfully integrate “interiority” with other adaptation strategies and its focus on worldviews or developmental stages of consciousness.

Integrating Interiority

Interiority refers to the intangible, unseen domain of life that cannot be objectively measured by the senses. It includes beliefs, understanding, morality, motivations, values, and worldviews, which are represented in the Upper-Left (UL) and Lower-Left (LL) quadrants of the Integral framework. Integrating the Left-Hand quadrants *along with* the Right-Hand quadrants that emphasize systems, technology, and behavioral change enables a broader and deeper view of adaptation. Opening up approaches to adaptation to include interiors introduces numerous new methods and techniques that foster Left-Hand quadrant adaptive capacity, which in turn influences right-hand quadrant measures (i.e., the systems, technological, and behavioral dimensions).

The interior perspectives most certainly contribute to climate change adaptation, as one quickly notices in any community meeting about actions to mitigate and adapt to climate change. That is, people’s subjective beliefs and assumptions, as well as cultural (and often implicit) norms, tangibly impact both discussions and actions in response to climate change. Integral Theory makes explicit room for these major perspectives to be present and integrated. Thus, with this approach, it is possible to bring together the best of science, community engagement, and personal meaning-making into responses and adaptations to climate change.

It is important to note that not everyone needs to be an expert in all quadrants. However, it is extremely useful to acknowledge the importance of the other perspectives, as well as their relationship to one’s own work, even when specializing in one particular field. Often in contemporary approaches to adaptation, specialists identify measures and strategies to reduce vulnerability to a particular impact. Yet this third-person objective perspective tends to leave out realities associated with second-person perspectives (which can be discerned through community dialogues or collaborative inquiries) and first-person perspectives (which can be examined through self-reflection or mindful inquiry). While this is not surprising in a modern, rational cultural context, it is nonetheless important to integrate interiors—or, as Wilber (1996) emphasized over a decade ago, to bring back depth from the “flatland” of both rational science and postmodern relativism.

The relationship between resilience and adaptation is an area where the benefits of an Integral approach can be readily seen. Resilience is emerging as a key concept in the climate change adaptation discourse, and many scientists are studying the resilience of social-ecological systems to disturbances and changes associated with climate change and other environmental processes (Folke, 2006). This focus on *social-ecological resilience*—or the capacity of a system to tolerate disturbance without collapsing, to withstand shocks and to renew itself when necessary, has provided new insights into ecosystem and resource management. Yet these studies seldom include the notion of *human resilience* and interior adaptability in the face of both uncertainty

and change. Human resilience represents a conscious reframing of the issue and its cause, and also a new mental model of one's role in causing and addressing climate change. Many of the psychological impacts of change, whether in relation to disasters, population displacement, or simply the loss of something valued, have been addressed by the fields of social work, mental health, humanitarian work, and even in business management. In certain social work and community development contexts, the term *community resilience* has been coined to address the needs for cultural identity and community well-being in the face of rapid, unequal changes produced by globalization. Community resilience primarily refers to resilience in cultural and social systems, such that humans are able to anticipate and plan for the future. It also involves the recognition of collective responsibility, and honoring of one's own cultural identity while also expanding cultural identities beyond "us" and "them" thinking. Cultural factors such as traditional knowledge have been recognized to influence resource management (see Berkes, 2008). An Integral approach proposes that social-ecological, human, and community resilience will *all* be needed in order to face the myriad changes provoked by global climate change—changes that arise in ecosystems and economies as well as in cultures and consciousness. Integral Theory provides a framework for examining how resilience arises in all domains of reality, contributing to ecological adaptation, behavioral adaptation, cultural adaptation, and psychological adaptation.

Climate change (and responses to climate change) will have significant impacts on ecosystems, infrastructure, and resource-based activities such as agriculture and fisheries. It will also influence cultural practices and icons, and affect experiences that people value (Fox, 2002; O'Brien & Wolf, in press). In other words, the impacts of climate change and the responses to climate change will affect what matters to individuals and groups. The failure of scientists, decision-makers, and citizens to recognize and respond to the subjective dimensions of climate change is itself dangerous, in that it is reductionist and promotes a partial and insufficient diagnosis of the problem, and of the solutions.

The dramatic societal transformations that are needed to avoid what scientists refer to as dangerous climate change and irreversible tipping points cannot be fully met through rational, positivist measures to mitigate and adapt to climate change alone. There is a need to consider how individuals and groups perceive the challenges and opportunities associated with climate change, to identify what matters to them, and to be aware that the very idea of anthropogenic climate change may affect—and be affected by—worldviews and beliefs. In fact, for many individuals and cultures, adaptation to climate change may involve adapting to a new worldview.

Worldviews, Awareness, and Motivation

In this section, we consider what adaptation might look like from different levels of awareness or consciousness, providing us with insights into the spectrum of motivations for adaptation strategies, as well as how value conflicts emerging from different perspectives can influence adaptation processes. We draw here on the research of developmental psychologists who study meaning-making and have found that there are various *orders of consciousness* or *worldviews* that develop through a human life-span (Kegan, 1995; Cook-Greuter, 2006). Each of these worldviews give rise to different understandings of climate change—and change in general—as well as to different motivations to act and different prioritized responses. Understanding different worldviews and motivations can be useful in identifying the factors or actions that support or thwart sustainable adaptation to climate change (Brown, 2007). In some cases, it may not be enough to promote adaptive measures; it may be just as important to reduce opposition to adaptive actions.

With a traditional worldview, beliefs that a supreme other (God, Allah, etc.) will protect and take care of humanity often occlude a full understanding of the rational science of climate change. No matter how many statistics are presented, those holding this worldview will simply not see the issue in the same way as scientists with a rational worldview see it. In some cases, in fact, human attribution may be vehemently denied in relation to climate change. Different worldviews also influence responses to climate change. For example, often those with a modern worldview, which tends to value individualism and achievement, are likely to prefer voluntary emissions trading schemes to responses that aim for compulsory reductions of greenhouse gases based on appeals for social equity, climate justice, and the rights of future generations.

Here we describe some of the worldviews present in most communities today, with mention of how meaning is made at that stage and what motivations tend to arise. These examples are drawn from the authors' direct experience working in climate change adaptation and sustainability.

I. Traditional/mythic

Traditional/mythic worldviews include an ability to take a second-person perspective (Kegan, 1982). Meaning-making here tends to focus on "us" and our people, and splits reality into black and white, or good and evil. Often, but not always, this is associated with religious or mythic views. It is also associated with conservatism and a reminiscent view of the "good old days," which are in most cases considered more sustainable. This misses the fact that these "old days" were not inherently sustainable, but sustainable by default because of factors such as lower populations and the lack of technologies with the potential for destruction. Some proposals for climate change adaptation from this worldview include going back to the land and fostering community resilience through diversified livelihoods, while constraining community inflows and outflows so as to prioritize one's own survival. Concerns about immigration and security are often emphasized. The fact that climate change is a global phenomenon is often missed, as motivations extend primarily to one's own people (e.g., family, community, and country), without much concern for "the others." An example of a healthy expression of this worldview can be witnessed when local efforts to adapt agriculture to changing conditions are linked to fair trade initiatives that promote sustainable land use practices (e.g., through low-input farming of drought-tolerant crops).

II. Modern/universalistic

A modern/universalistic worldview includes an ability to take a third-person perspective (Kegan, 1995). Meaning-making here tends to focus on science and innovation, emphasizing the study of the scientific aspects of climate change, its links to peak oil, and the potential for renewable energy. Responses that promote individualism and (corporate) freedom are often prioritized, including carbon trading, corporate wind farms, and support for avoided deforestation projects as a segue toward (and sometimes instead of) reduced industrial emissions. This worldview rarely sees global social justice as part of the climate change issue, nor does it recognize the strong links between sustainable development and adaptation. An example of a healthy expression of this worldview is the ability to place centralized, corporate structures for renewable energy in service of a comprehensive adaptive strategy at multiple scales—avoiding carbon emissions regionally and globally, providing income and livelihoods for individuals and households, and contributing to locally sustainable climate change adaptation.

III. Postmodern/pluralistic

A postmodern/pluralistic worldview is characterized by the ability to take a fourth-person perspective (Kegan, 1995). Meaning-making here tends to focus on the complexity of the issue, and it sees social justice dimensions and an ethical need for “thinking globally, acting locally.” Such a worldview emphasizes “leveling the playing field,” values multiculturalism, and appreciates the relative nature of the climate change issue; often it includes a clarion call for more ethical and sustainable ways of going about adaptation. Postmodernists will be the first voices to critique carbon trading mechanisms, ecological modernization, and corporate models for responding to climate change. The complexity of the situation that has caused climate change is generally well understood (e.g., overconsumption, overreliance on fossil fuels, linear extraction of resources from the hinterlands to centralized locales), yet the proposals for moving forward are not always realistic (i.e., organic gardens in every household, biking not driving, “staying put,” recycling) because they are guided by the assumption that everyone will soon have green values and worldcentric awareness. Developmental researchers stress that this is not something that is likely to happen anytime soon, as changes in worldviews rarely happen quickly (Kegan, 1995). Moreover, a strong emphasis on consensus-building may lead to endless debate and little action. An example of a healthy expression of this worldview is when the complex analysis of the climate change issue is held with regard for the complexity of the interior landscape of humanity—lessening the instantaneous critique of anything modern/corporate and allowing multiple entry points for solutions, depending on a diversity of values and worldviews.

The Integral approach raises some key points for working with worldviews and a spectrum of consciousness and awareness in relation to climate change adaptation. First, it is important to be aware of whom one is talking to, and to inquire deeply into what they believe and why, and how they construct meaning. Often this is best done by becoming familiar with the literature on developmental stages and then bringing this into application via intuitive and/or empirical assessments (see Wilber, 1996; Cook-Greuter, 2006). Intuitively, everyone is innately tuned into what will create good communication, while empirical researchers can provide tools for developmental assessments that can be brought into projects with ethical, skillful means. Secondly, ensure that adaptive strategies can simultaneously meet the population where they are (i.e., at their existing stages), while providing some learning ground for the emergent stages. For example, when working with a population coming from a traditional worldview, ensure that the adaptive strategies relate to traditional beliefs and values, while also providing some learning ground for including modern, rational viewpoints as well as postmodern viewpoints related to climate change adaptation. Thirdly, it is necessary to include researchers and practitioners as part of the process. What each person “sees” is closely related to their own worldview, consciousness, and awareness. Working with one’s own awareness as it develops and changes is essential to building leadership skills needed for both adaptation research and practice. Finally, it is essential to release the need for everyone to “be on the same page” or “at the same stage,” as most development research suggests that populations are spread across three or four major worldviews (i.e., traditional/mythic, modern/universalistic, or postmodern/pluralistic, with some emerging integral worldviews). Some environmentalists cling to a utopian ideal, where everyone is “pluralistic” and “worldcentric.” However, given the urgency of responding to climate change, this is an unrealistic scenario that may hinder rather than promote adaptive responses.

From Theory to Practice: Integral Adaptation to Climate Change

Moving from ideas into action is always exciting and difficult. As scholar-practitioners, we have been mus-

ing on the need for deeper, broader processes for adaptation, studying what Integral Theory has to offer the climate change discourse, and have described here what an integral approach to adaptation might look like. So far, this is based on existing projects, community engagement, and research, as well as ongoing dialogues among our colleagues and peers. However, we have not yet put these ideas fully into action, translating the theory into practice. At the present moment, we are designing a research project that aims to do exactly that, focusing on vulnerable communities in El Salvador. Through this research project, we hope to develop a model that could be applied in other communities and regions of the world. In this section, we share some of the design ideas from this project proposal as a means to suggest how we might bring integral adaptation into practice.

Firstly, any adaptation strategy would do well to recognize that adaptation to climate change involves not only adjustments in behaviors and systems, but also cognitive and cultural adaptations, including adjustments to the very notion that humans are changing the climate. With this in mind, an Integral approach to adaptation to climate change seeks to develop capacity for adaptation in four key areas, based on the quadrants (i.e., personal change, behavioral change, cultural change, and systemic change). Building capacity in each area requires concrete, well-defined actions, which will then have a notable influence in the other areas. The four areas are summarized below:

1. *Personal adaptation.* Foster individual reflective capacity to shift self-identity from passive victims to active, empowered leaders of change, which includes working with beliefs, values, attitudes, and worldviews, including in relation to climate change adaptation. This capacity is particularly important among leaders at all levels and scales.
2. *Behavioral adaptation.* Enhance the capacity of individuals to learn new skills, employ practices that support sustainable adaptation, and engage in resilient livelihoods. This includes enhancing skills and technology for value adding/processing as well as skills and technology for improved energy supplies for poor groups.
3. *Cultural adaptation.* Increase community resilience (involving interpersonal and social capacity) to address vulnerability and negotiate adaptation strategies justly, actively, and sustainably.
4. *Systemic adaptation.* Increase the capacity to address the systemic factors that contribute to community resilience at the local level (e.g., by fostering good governance processes/systems and economic diversification), at the national level (e.g., enhancing access to resources, technologies, education, health services; enhancing the legal rights of poor; improving people's income generating activities); and at the international level (e.g., transfer of knowledge and good practices, access to international adaptation funds).

Secondly, an Integral approach to adaptation would need to create adaptive strategies that are meaningful and make sense to people, without losing the bigger picture and including contributions from other worldviews. For example, adaptation in coastal communities in El Salvador might need to resonate with a traditional

worldview, providing adaptive strategies that work for the local economy, land use, and culture. At the same time, an Integral approach that is able to be conversant with multiple worldviews would also draw upon modern and postmodern adaptive strategies, such as pro-poor carbon trading mechanisms and reduced environmental degradation and destruction (REDD) programs. This ability to work across and between worldviews and levels of consciousness could bode well for more stable, resilient, and ultimately effective adaptation to the impacts of climate change.

Within any given context, the specific measures and actions for climate change adaptation will be different. The common principle is that the practice of adaptation should emphasize actions in all four quadrants and recognize the existence of different worldviews and levels of consciousness or awareness. This “interiority” influences attitudes, behaviors, and decisions in response to climate change, and towards change in general. Science is making it increasingly clear that some climate change is inevitable based on lags in the earth-atmosphere-ocean system (IPCC, 2007a). It is also becoming clear that human beings, species, and ecosystems will have difficulty adapting to rapid, non-linear change at the rate, magnitude, and scale that is projected based on climate models (Adger et al., 2009). The most viable alternative for a secure and sustainable future is to adapt systems, behaviors, cultures, and individual consciousness to a new global reality, that humans are changing the climate, and take actions and measures that address this quickly and effectively. Because such adaptations are unlikely to occur spontaneously at a global scale, it is important to promote integral leadership at all levels and scales.

Conclusion

The contribution of rational, positivist science to understanding the Earth system has been revolutionary. The modern worldview has provided the tools and methods for the development of both theoretical and empirical insights on the climate system. From the development of Arrhenius’ theory of the greenhouse effect in 1896 to the IPCC Fourth Assessment Report’s (2007a) conclusion that “the warming of the climate system is unequivocal” (p. 3), there have been incredible advances in science, including the development of general circulation models of the atmosphere, oceans, and cryosphere, remote sensing instruments, paleoclimatology methods such as ice cores and radio-carbon dating, and so on. These developments have contributed to a broad scientific consensus that humans are changing the climate, but responses to these changes, which we have discussed here as “adaptation,” require more than a systems approach.

We have argued in this article that the science on understanding the causes and severity of climate change and the advances into technological adaptations have far overshadowed the potential contributions of the social sciences, psychology, and cultural research into how society can adapt to these very different life conditions. There is already substantial knowledge in these areas, but it has not been adequately recognized and integrated. Our stance is one of integrating the existing breadth of scientific and technological knowledge with an increasing body of research into the social, psychological, and cultural dimensions of adaptation. To do so, we discussed a transdisciplinary framework based on Integral Theory. Integral Theory not only brings these disciplines together such that they can be in dialogue, but also situates the locus of engagement slightly above the single disciplines so to draw insights from all, not favoring any to the exclusion of others. We conclude that such a transdisciplinary approach is now called for, whereby disciplines do not compete with or dismiss one another, and instead act in concert and create synergy.

Integral adaptation to climate change can foster radical transformations in the way that we think about responding to change, from something that society manages through behavioral and systems changes to something that humans consciously create in alignment with their beliefs, values, and worldviews. In this era of rapid global change, which is considered by some to be manageable and exciting and by others to be out of control and frightening, the process of climate change challenges humans to reflect on change itself. A wider interpretation of climate change—as a challenge to human understanding of change in general—has tremendous implications. It means that leaders, advocates, and decision-makers working on climate change adaptation must look beyond modern and postmodern perspectives, which consider only the biophysical impacts of climate change or the differential vulnerability and issues of equity and social justice, respectively. These leaders must truly lead others, not only to make meaning of climate change from their existing stage, but also to adopt an entirely new perspective, including (for those that are ready) an integral perspective that recognizes the need for change in experience, behaviors, culture, and systems (i.e., all quadrants) as well as the need to take into account the different worldviews, prioritized values, and stages of development (i.e., all lines, all levels) that influence adaptation decisions, strategies, and behaviors.

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Climate change (increases in temperature, changes in precipitation and decreases in ice and snow) is occurring globally and in Europe; some of these observed changes have established records in recent years. Observed climate change has already led to a wide range of impacts on environmental systems and society, and include: Coasts and European seas: overall rise in sea levels; increase in ocean acidification, sea surface temperature and ocean heat content; earlier seasonal appearance of various marine species; northward expansion of some fish and plankton species. Adaptation, along with mitigation, is an essential part of addressing the challenges and opportunities associated with climate change. Mitigation refers to our efforts to limit the man-made causes of climate change. Convention on Biological Diversity Climate change adaptation Conference of the Parties Climate-smart agriculture Civil society organization Disaster risk reduction Ecosystem-based adaptation to climate change European Commission Ecosystem-based disaster The Secretariat of the Convention on Biological Diversity would like to acknowledge the financial assistance from the European Union and the Government of Sweden towards the preparation of the voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information. Data and research on climate change including adaptation, climate finance, international climate framework, carbon markets, UNFCCC, cities, flood risk, Climate Change Expert Group (CCXG). , OECD work on adaptation to climate change focus on two main areas: (1) adaptation policies and economics and (2) Adaptation and development co-operation. Climate change poses serious, wide-ranging risks to economies, societies and ecosystems. These risks include: damage to coastal infrastructure, shifting patterns of infectious diseases and loss of food security. Reducing these risks requires action to sharply reduce greenhouse gas emissions (mitigation), combined with measures to increase resilience to the impacts that occur (adaptation). Climate change can make it more difficult for communities to provide drinking water and wastewater services, protect water quality, and maintain healthy aquatic environments. The Adaptation Strategies below offer possible ways to address anticipated climate risks to water management. Water Utility. Water Quality. Ecosystem Protection. Waste. Climate change can make it more difficult to properly manage hazardous and non-hazardous wastes. The pages below offer possible ways to address anticipated climate risks to contaminated site management and disaster debris management. Waste Facility Protect Adaptation to the effects of climate change is now acknowledged as necessary for responding effectively and equitably to the impacts of climate change. Top. Adaptation versus Mitigation. The terms "adaptation" and "mitigation" describe two actions that are essential in the climate change area. The impacts of climate change will be more visible in low lying coastal areas in terms of sea levels and storm activities. Infrastructure such as runways and buildings at some airports could be impacted because of rising sea levels (see article Adapting to Climate Change at Airports, Chapter 6 of this report). According to a preliminary review of an OECD Report 5, 64 airports have been identified as likely to be affected by the predicted rise in sea levels.