Journal of Northwest Anthropology, 48(2):189–201 2014

INSIGHTS ON ADAPTIVE CAPACITY: THREE INDIGENOUS PACIFIC NORTHWEST HISTORICAL NARRATIVES

Benedict J. Colombi and Courtland L. Smith

ABSTRACT

Adaptive capacity is the ability to cope with changing, novel, and surprise situations. Narratives of adapting to change, which often transforms cultures, suggest hypotheses for addressing social and environmental change. By describing three historical narratives exemplifying greater adaptive capacity, we share Indigenous stories of gaining cultural capacity and adapting to change in novel and unexpected ways. The narratives are: (1) Grand Ronde tribal restoration of sovereignty and resilience; (2) Columbia River tribal salmon supplementation and cultural knowledge; and, (3) the Nisqually leadership with Billy Frank Jr. Our aim is to provide insight into adaptive capacity by showing how Indigenous people and cultures adapt to new settings and situations and how historical narratives can offer additional insight into the most important variables and cultural dimensions for explaining adaptive capacity.

Introduction: Novel Systems, No-analog Futures, and Surprises

As cultures head into an unknown future onto which they have stamped their significant footprint, lessons from previous experience may provide insight on adaptations to novel systems of the future. Writing in the journal *Science*, Douglas Fox predicts a "messy world in 2100, as surviving species reshuffle into entirely new combinations, creating "no-analog" ecosystems" (2007:83). We extend Fox's predictions by showing how cultures adapt to change, contending those with adaptive capacity—the ability to adapt to new settings and situations—have greater potential to persist in the face of change and surprise.

Three historical narratives from the Pacific Northwest of North America exemplify adaptive capacity. These are Indigenous stories of gaining cultural capacity and adapting to change in novel and unexpected ways. The stories reveal strategies of developing portfolios with multiple sources of economic support, using sovereignty, vision, and leadership, building trust and partnerships, and gaining knowledge to confront surprises and unanticipated futures.

In the first narrative, we show how the Confederated Tribes of Grand Ronde gained restoration of their sovereignty and showed the resilience to adapt to threats to their culture through economic portfolio building, language revitalization, and tribal knowledge. In the second narrative, we describe how Columbia River tribes applied cultural values and knowledge to provide the salmon production alternative of supplementation to bring back lost and depleted salmon populations. In the third narrative, we use the example of Billy Frank, Jr., a Nisqually elder, to show how leadership and ecological knowledge helped in restoration of Puget Sound salmon.

Methods

The comparisons in this article are based on anthropological fieldwork and tribal narrative archives. Our collaboration came about as part of the School for Advanced Research, Advanced Seminar Series and book, *Keystone Nations: Indigenous Peoples and Salmon across the North Pacific* (Colombi and Brooks 2012). We titled the edited-volume *Keystone Nations* to examine the histories and futures of Indigenous peoples and salmon and to "signal the marriage of the biological and social sciences" (Colombi and Brooks 2012:xi). Smith's (2012) chapter examined generalizations around issues of Indigenous and non-Indigenous management practices, showing how each region across the North Pacific is affected differently by agricultural metaphors and their application to salmon fisheries as well as watersheds. Colombi's vision of *Keystone Nations* explored salmon as a cultural keystone species (Garibaldi and Turner 2004), showing how salmon serve as pillars of culture, history, and economy in the North Pacific as well as North Atlantic regions. His individual chapter (Colombi 2012b) focused specifically on Nez Perce themes of Indigenous knowledge about salmon, fishing policies, water and fishing rights, the tradition of treaties, co-management experiments, and commercial "cultivation" versus the preservation of "wild" salmon.

Our approach takes a conceptual view of the economy and ecology, society and polity, ideology and knowledge dimensions of culture. We argue that the terms and concepts associated with each cultural dimension are numerous and multi-layered. In the dimension of economy and ecology, sovereignty and portfolio building are the main elements creating resilience in adapting to cultural threats. In the dimension of society and polity, leadership that engenders vision and trust is key, as are partnerships to achieve goals in complex systems. For dimension of ideology, local, ecological and contextual knowledge, including the willingness to act in concert with the associated values are key. Local knowledge helps knowing the opportunities of a place. Ecological knowledge helps knowing the processes of adaptation, and contextual knowledge allows people to see opportunities beyond their local places. Ecological values of seeing one's self and one's culture as a part of, but not dominant over a place is important for adapting to new realities.

Restoration and Resilience: Grand Ronde

A brief summary of the Grand Ronde historical narrative provides background for discussion of adapting to change and gaining cultural restoration of sovereignty and resilience through economic portfolio building, language revitalization, and tribal knowledge. The Grand Ronde tell their own story, which we paraphrase as an example of the capacity to adapt, and even transform, culture in the face of tremendous change (CTGR 2014). Despite a history of being forced onto a reservation, believing they would all die, failing to have binding legal agreements kept, and having their federal trust status terminated, the Grand Ronde continue to persist, as evidenced by their tribal community at Grand Ronde, Oregon.

Before treaties with the United States in 1854, the 26 tribes and bands that became The Confederated Tribes of Grand Ronde lived in the area west of the Cascade Mountains from northern California to the Columbia River. Prior to contact, the groups that made up the Grand Ronde had a subsistence portfolio of aquatic and terrestrial resources—salmon, skakwal (eels), mammals, camas, wapato, hazelnuts, acorns, and huckleberries. They also quarried obsidian and traded with neighbors.

Between 1853–1855, the Willamette Valley tribes and those south to Shasta signed treaties and were "awarded" 61,440 acres for the Grand Ronde reservation (Lewis 2009), along with other

promises for schools, farming equipment, and supplies. In 1856, about 2000 members these tribes moved to the Grand Ronde reservation (CTGR 2014). The move was so disruptive, that elders talked about wishing to die in the lands of their ancestors rather than move to the reservations. By 1901, 33,468 acres were allotted to 274 individuals and the remaining land was sold as surplus. By early 1930s, around 300 Grand Ronde made their living as mill workers, farm laborers, and arts and crafts specialists. They were suffering from poor health, lack of utilities, and difficult living conditions (Lewis 2009). With the Indian Reorganization Act of 1936, the tribal council, which had been in existence since 1873, established a constitution and bylaws. Next came the termination policy of the U.S. government in 1956, which stripped away federal recognition, terminated the reservation, ended federal trust responsibilities, set policy to "colonize the remainder of their lands through Federal termination policy" (Lewis 2009:iv). The Grand Ronde was left with next to nothing; the Grand Ronde reservation was reduced to a storage shed and cemetery on 7.5 acres.

In the 1970s, several leaders emerged who wanted to restore Grand Ronde lands, society, and culture (CTGR 2014). In 1983, the tribe regained its sovereignty and 9,811 acres were returned in 1988 (Lewis 2009). By 2010, the Grand Ronde reservation was over 11,000 acres, including forest lands and a casino, firefighting departments, and craft activities.

Most interesting about the tribe is how members carved its ideology and identity out of many different linguistic and cultural heritages to become the Grand Ronde, whose language is *Chinuk Wana* (CTGR 2014). Moreover, they retain their knowledge and interest in natural resources. Thus, their adaptive ability includes an economic producing portfolio, a built environment, and strong leadership with a vision for a future that includes a more adaptive tribal capacity. Knowledge of historic ways, language, and the broader society enabled the Grand Ronde to survive both conscious and unconscious efforts for their eradication.

Based on work by Walker (1967), Menzies (2010, 2012), Colombi (2012a, 2012b), and others on adaptation to natural variability (Langdon 2006, 2007), we were surprised that the Grand Ronde narrative did not mention their ecological relationships as much as their struggles with U.S. government policies and actions. Grand Ronde economic patterns show evidence of resource shifting and substitution in pre-reservation times between aquatic and terrestrial portfolios of resources (CTGR 2014). From their settlement on the reservation, up to and including federal termination, various forms of farming and wage labor sustained families. The restoration of sovereignty era was a time of using casino revenues to diversify their economic portfolio.

A strong tribal portfolio consists of multiple economic activities and the sovereignty that enables a group to control its economy. Sovereignty typically implies having rights to a resource. Most often sovereignty is in a land base, but it could also be fishing or hunting quotas, mineral or water rights, access to economic activities open to tribal groups, or ownership of intellectual property. The Economics Resource Group, Inc. (1998) noted, "Tribes that establish their own decision-making power over resources and take control of their economic destinies are better off than tribes that accede to outsiders' decisions, goals, plans, or programs" (The Economics Resource Group, Inc. 1998).

The Grand Ronde restored their sovereignty in the face of change. The primary tools used by the Grand Ronde were leadership and sovereignty. By leadership, we mean tribal leaders with a vision about the tribe's future and their ability to gain the sovereignty to achieve that future. They still had a piece of their tribal identity in the small cemetery near the current tribal headquarters. With sovereignty, they obtained a land base, albeit much smaller than the original territory. Tribal leaders had the vision to produce a very high value economic activity on their sovereign land base where they could exercise a competitive advantage in building a casino.

Can the Grand Ronde be called resilient? Resilience is the capacity to absorb and adapt to disturbance or change while maintaining essential functions (Walker and Salt 2006). Through the precontact, reservation, and restoration periods, the Grand Ronde maintained a tribal identity and polity. Further, their resilience was maintained by portfolios that provided multiple sources of economic support, collaborations and connectedness to get political support for goals, and learning and new knowledge (Gunderson and Pritchard 2002:264). The Grand Ronde merged several diverse cultural identities from the pre-contact period into a unified culture in the reservation period and then synthesized cultural elements from several groups to develop their tribal beliefs and language after restoration of sovereignty. The Grand Ronde can be said to be very adaptive, actually conceiving and implementing different states while maintaining their basic cultural identity.

The Grand Ronde faced and made many changes from being wide-ranging groups of foraging people, to being forced into one group on a reservation and encouraged to be farmers and wage laborers in a money economy, and to their current status as a modern corporate entity. These represent at least three structural changes or transformations (Trosper 2009) showing the resilience of their culture.

Cultural Framework for Adaptive Capacity

How can a cultural framework help in understanding adaptive capacity? Culture we conceptualize as a basic concept for understanding adaptation and are a valuable tool for learning how people construct and manage their world. Environments both affect cultures and what they can do and are affected by culture. Adaptation is the iterative process of change as cultures adapt and environments change. Colombi (2012a) defines culture as what people think, make, and do. Culture is learned and shared, and includes symbolic information and meanings encoded in language, behavior, and objects. Culture is "created, maintained, revised, and reproduced through time" (Colombi 2012a:79). Environmental change that is either culture-directed or natural can be addressed with cultural solutions.

Social scientists use the dimensions of the ecology and economy, society and polity, and ideology and knowledge when describing culture. The holistic nature of culture suggests that insights into cultural adaptation should be found in each of these three dimensions. In Table 1, several efforts at parsing culture are linked with economy and ecology, society and polity, and ideology and knowledge—the make, do, and think categories that Colombi (2012a) mentions. The top three rows give social science thinking from Colombi (2012a), Bodley (2005), and Harris (1979). These are followed by brief descriptions of Grand Ronde culture during the three structural changes—precontact, reservation, and restoration of sovereignty.

Ideology and Knowledge: Columbia River Tribal Salmon Supplementation

An interesting feature of Pacific Northwest tribal ideology and knowledge is how it guides adaptive capacity. For example, Columbia Basin tribal values have informed modern non-tribal science with alternatives to some salmon restoration practices. In 1994, four of the Columbia River tribes—Nez Perce, Umatilla, Warm Springs, and Yakama—created an organization and plan for restoring Columbia River salmon and steelhead runs that had been listed as threatened and endangered (CRITFC 2006). The tribes used their knowledge to develop resource restoration and management strategies (Trosper 2002, 2003).

TABLE 1. COMPARISONS OF CULTURE DIMENSIONS WITH LITERATURE IN ANTHROPOLOGY AND WITH THE GRAND RONDE HISTORICAL NARRATIVE.

Dimensions of Culture	Economy and Ecology	Society and Polity	Ideology and Knowledge
Colombi (2012a)	make	do	think
Bodley (2005)	material	behavioral	mental
Harris (1979)	infrastructure	structure	superstructure
Grand Ronde: precontact	portfolio of aquatic & terrestrial resources and sovereignty over territories	26 tribes operating as independent units with their own social and governance systems	believing themselves to be part of natural systems
Grand Ronde: reservation	household income as small farmers and low-wage, logging, and farm labor jobs.	emergence of tribal social organization and governance	valuing their traditional cultural ideas & knowledge
Grand Ronde: restoration of sovereignty	casino on sovereign lands and diversified economic portfolio	more formalized tribal governance and polity	creation of synthetic language & culture

As an example, the tribes have challenged the dominant culture's concept of using hatcheries to augment salmon stocks, a practice that began in the 1870s. After 100 years, salmon stocks had plummeted to a level of about seven percent of historic levels (NPPC 1986). To address the hatchery part of the problem, the tribes insisted that hatchery practices needed reform. They used their cultural knowledge and suggested building supplementation facilities. The idea of supplementation is to model artificial propagation as closely as possible to the life ways of salmon. The tribes argued for the use of supplementation facilities to restore lost salmon populations. As scientists debated the relative merits of hatcheries, no artificial propagation, and supplementation (Licatowich 1999; Taylor 1999, Araki et al. 2008;), the tribes produced evidence that supplementation works better than hatcheries to increase abundance and re-establish runs (Galbraeth 2011).

In establishing hatcheries, the Nez Perce tribal fisheries program emphasizes that their hatcheries differ from those operating on the basis of industrial logic (Ween and Colombi 2013). One such difference between tribal hatcheries and standard hatcheries is the difference in the hatcheries' purpose. While tribal fishery programs view hatcheries as a tool to restore naturally reproducing populations, standard industrial hatcheries are oriented towards increasing production for fisheries. In their work to reverse long-term decline, the Nez Perce argue that they draw upon their local knowledge of salmon as well as past knowledge derived from their horse breeding activities and former resource-management practices, all developed prior to European American

settlement (Colombi 2012b). For example, to avoid inbreeding and the lack of genetic suitability to a particular river environment, tribal hatcheries regularly incorporate wild fish as broodstock into their hatchery programs. Tribal hatcheries, moreover, aspire to "think like a salmon." To illustrate, the Nez Perce hatchery design incorporates a "natural" rearing pond in their hatcheries, which is an idea informed by Nez Perce cultural understandings of the "needs of the salmon," as noted by Ed Larson of Nez Perce Fisheries (Five Crows 2011). While conventional-industrial hatchery pens are straight concrete structures, Nez Perce supplemental hatchery designs uses local knowledge to mimic healthy riparian areas. The replacement of conventional hatchery pens with natural rearing ponds can reduce the genetic effect of captivity over generations. As Dave Johnson, Nez Perce Fisheries program manager, states "We will treat these fish with the respect they deserve.... They are not ours to do with what we will. Rather, they are a part of us; they share our world" (Five Crows 2011).

Leadership and Vision of Nisqually, Billy Frank, Jr.

A third narrative is the one of the Nisqually leader, Billy Frank Jr. Living at Frank's Landing near the western boundary of Joint Base Lewis-McChord, Billy Frank Jr. had a major influence on fishery management and landscape restoration practices.[i] His people have lived along the Nisqually River that enters Puget Sound near Olympia, Washington for at least 5000 years (Wilkinson 2000). Nisqually tribal history is like that of the Grand Ronde with being placed on a reservation, failed promises from the U.S. government, having children placed in Indian schools that did not allow practice of tribal culture, dominant culture values that promoted assimilation and homogenizing cultural differences, and, selfish, illegal, and negligent behavior of non-tribal neighbors.

Born in 1931, Frank grew up on the Nisqually River after his parents moved to a place that they liked better than the urban setting of Tacoma, Washington. Frank learned to fish and learned about the riches of the Nisqually traditional area. As a young man, he was part of the fish-ins of the 1960s and 1970s that brought civil rights activists to Washington State. In addition to the challenges faced by most tribes, the State of Washington asserted that it "could not allocate fish" to Northwest tribes (American Friends Service Committee 1970). The result of State policy was that fish wardens prevented tribal members from fishing in their usual and accustomed places. Because non-tribal fishermen took most of the fish in the Pacific Ocean and in Puget Sound, few were available for the Nisqually and other tribes who lived along the rivers that entered Puget Sound.

Frank's leadership brought the Nisqually together to fight for their fishing rights (Burns 2006). The Nisqually, and their neighbors the Puyallup and Muckleshoot, had little support, but the 1969 Belloni and 1974 Boldt Decisions decided the allocation argument. These decisions settled the fishing rights questions of Northwest tribes by saying that fish had to be made available at the usual and accustomed fishing places and that the tribes should have half the allowable catch of annual salmon runs (*United States vs. Washington*, 384 F. Supp. 312, W.D. Wash. 1974).

Frank became head of the Northwest Indian Fisheries Commission and developed a program of cooperative management between the tribes and non-tribal fish managers for Puget Sound. He also showed leadership with the military at Fort Lewis, which was created when Pierce County illegally condemned two thirds of the Nisqually reservation (Nisqually Indian Tribe 2014). Charles Wilkinson, an attorney who has worked with many tribes, summarizes Frank's leadership, ". . . if social progress is to be made, a leader must keep ever focused on the ultimate objective and must transcend stereotypes, past transgressions, and even personal hurts of the most profound nature" (Wilkinson 2000:80). Frank worked with the military on conserving and restoring landscapes on the

military reservation. He worked effectively with those who occupied Nisqually lands to protect and restore some of the natural ecological processes. Wilkinson (2000:66) says of Frank:

> [H]e never abandoned the warrior mentality he had honed on the banks of Frank's Landing during the Fish Wars. Big heart, yes; collaborative processes, yes; widest smile in the State of Washington, yes—but what mattered in the long term were the fish and the river and the land and the people.

In sum, a vision and strong leadership prepared Frank and the Nisqually people for the future. This is ultimately about setting emergent path, and Frank's example of effective leadership shows how vision and worldview can change the dynamics of a particular situation. Moreover, his leadership in salmon conservation and resource restoration has operationalized Nisqually adaptive capacity.

Adaptive Capacity

The Grand Ronde restoration of sovereignty, Columbia River tribes supplementation programs, and Nisqually leadership narratives reflect something more comprehensive and cultural about coping with new and novel situations. The concept of adaptive capacity is increasingly being used with issues such as climate change, resource conservation and restoration, business organization, and minority groups surviving to overcome discriminatory situations. USAID (2009:x) says,

> Adaptive capacity depends on economic well-being, ecological well-being, the extent of dependency on natural resources, infrastructure (human-built or natural), effectiveness of institutions and governance systems, insurance, secure land tenure and mediation measures, and information and communication systems. A community with the capacity to adapt is likely to be more resistant to impacts or able to recover from stressful events and conditions.

Other uses of "adaptive capacity" include Adger et al. (2007:727) saying, "Adaptive capacity is the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behaviour and in resources and technologies." Brooks et al. (2005) argue that the presence of adaptive capacity is necessary for effective adaptation strategies to reduce harmful outcomes. Adger et al. (2007:727) emphasize that adaptive capacity is influenced by social factors and governance structures as well as economic development and technology. They say that there are ". . . many examples where social capital, social networks, values, perceptions, customs, traditions and levels of cognition affect the capability of communities to adapt to risks related to climate change" (Adger et al. 2007:727). Adaptive capacity is also use by Intergovernmental Panel on Climate Change's (Parry et al. 2007), UN Food and Agricultural Organisation (FAO 2006), The World Bank (2010), The World Resources Institute (2009), United Nations Development Programme (UNDP 2005), and other organizations.

The Resilience Alliance (2014) links adaptive capacity with the adaptive cycle (Holling 1986). The Alliance points to Folke, Colding and Berkes (2002), who identify and expand on four critical factors that interact across temporal and spatial scales and that are required for dealing with natural resource dynamics during periods of change and reorganization—learning to live with change and uncertainty; nurturing diversity for resilience; combining different types of knowledge for learning; and creating opportunity for self-organization towards social-ecological sustainability.

Ecological economists emphasize various forms of capital that support adaptation to change. Costanza et al. (1997) have estimated the value of natural capital to world societies. Vemuri and Costanza (2006) broaden the types of capital by adding built, social, and human capital to evaluating human well-being. The narratives and the summaries of literature in Table 2 suggest many common concepts in each of the ecology and economy, society and polity, and ideology and knowledge dimensions. These three Pacific Northwest narratives suggest concepts that should be given more attention when considering adaptation to novel and no-analog systems and change (Colombi and Smith 2012). In sum, we argue Indigenous culture narratives and experience are a good source of long-term data for generating hypotheses about adaptive capacity as a cultural process.

Conclusion

Cultural adaptation is about system complexity, resilience, and adaptive capacity. The three tribal narratives emphasize elements of adaptive capacity within each of the three cultural dimensions. Ecology and economy encompasses the ideas of resilience and the economic relations that tribal cultures practiced in their relations with resources and ecological processes. Tribes built economic portfolios that allow substitution and shifting between activities to deal with variability. Sovereignty is critical to control of resources or establishing rights to engage in an activity limited to sovereigns, i.e., gaming and tribal economic portfolios that can be built from these revenues. Society and polity include the leadership and vision to adjust to novel and no-analog futures. Leaders who have vision engender trust and create new opportunities. Further, these leaders build partnerships with others to achieve their goals. Ideology and knowledge, the third dimension, is about the values people have, the learning they engage in, and the new knowledge they gain. Knowledge at the local, ecological, and contextual levels was critical for the tribes to establish casino gaming, supplementation facilities, and to fight for their legal rights. Having concern for a place, too, is important, especially when sovereignty is so often tied to a land base.

Further progress requires more study, discussion, and synthesis of cultural concepts and processes. Historical narratives can offer insights into the most important variables and relations to use in explaining adaptive capacity. In addition, historical narratives can be useful for identifying the variables and processes necessary to adapt to predicted novel and no-analog futures. Adaptive capacity is the ecological and economic, socio-political, and ideological dimensions of culture that enables societies to be flexible, adaptive, and knowledgeable in the face of unknown futures. The conversation of what makes communities and cultures capable of adapting to change is really about which societies' narratives will survive into the future

REFERENCES CITED

Adger, W.N., S. Agrawala, M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smith and K. Takahashi

2007 Assessment of Adaptation Practices, Options, Constraints and Capacity. In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson, pp. 717–743. Cambridge University Press, Cambridge, UK. <http://www.ipccwg2.gov/AR4/website/fi.pdf> (accessed on 13 February 2014).

TABLE 2. COMPARISONS OF ADAPTIVE CAPACITY ELEMENTS WITH DIMENSIONS OF CULTURE FROM A SELECTION OF SOURCES.

Dimensions of Culture	Economy and Ecology	Society and Polity	Ideology and Knowledge
Colombi (2012a) Bodley (2005) Harris (1979)	make material infrastructure	do behavioral structure	think mental superstructure
USAID (2009:x)	natural resources, infrastructure (human-built or natural), secure land tenure	effectiveness of institutions and governance systems, insurance, and mediation measures	information and communication systems
Adger et al. (2007:727)	economic development and technology	social capital, social networks, governance structures	human capital, values, perceptions, customs, traditions and levels of cognition
Resilience Alliance (Folk 2001 et al.)	nurturing diversity for resilience	creating opportunity for self-organization towards social-ecological sustainability	learning to live with change and uncertainty; combining different types of knowledge for learning
Capital (Costanza et al. 1997)	natural, built	social	human

American Friends Service Committee
1970 *Uncommon Controversy: Fishing Rights of the Muckleshoot, Puyallup, and Nisqually Indians*. University of Washington Press, Seattle.

Araki, H., B. A. Berejikian, M. J. Ford, and M. S. Blouin
2008 Fitness of hatchery-reared salmonids in the wild. *Evolutionary Applications*, 1:342–355.

Bodley, John. H.
2005 Cultural Anthropology: Tribes, States, and the Global System. McGraw Hill, Boston, MA.

Brooks, N., W. N. Adger, and P. M. Kelly
2005 The Determinants of Vulnerability and Adaptive Capacity at the National Level and the Implications for Adaptation. *Global Environmental Change*, 15(2):151–163.

Burns, Carol. M.
2006 As Long as the Rivers Run [videorecording]. Survival of American Indians Association, Olympia, WA.

Colombi, Benedict J.
2012a Salmon and the Adaptive Capacity of Nimiipuu (Nez Perce) Culture to Cope with Change. *American Indian Quarterly.*

Colombi, Benedict J.
2012b Salmon and His People: Nimiipuu Encounters with Global Capitalism. In *Keystone Nations: Indigenous Peoples and Salmon across the North Pacific*, edited by Benedict J. Colombi and James F. Brooks, pp. 183–206. School for Advanced Research Press, Santa Fe, NM.

Colombi, Benedict J. and James F. Brooks
2012 *Keystone Nations: Indigenous Peoples and Salmon across the North Pacific*. School for Advanced Research Press, Santa Fe, NM.

Colombi, Benedict J. and Courtland Smith
2012 Adaptive Capacity as Cultural Practice. *Ecology and Society*, 17(4):13.

Costanza, R., J. C. Cumberland, H. E. Daly, R. Goodland, and R. Norgaard
1997 *An Introduction to Ecological Economics*. St. Lucie Press, Boca Raton, FL.

CRITFC (Columbia River Inter-Tribal Fish Commission)
2006 *Wy-Kan-Ush-Mi Wa-Kish-Wit: The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes.* <http://www.critfc.org/text/trp.html> (accessed on 21 August 2011).

CTGR (Confederated Tribes of Grand Ronde)
2014 *Ntsayka Ikanum: Our Story*. <http://www.grandronde.org/ikanum/index.html> (accessed on 13 February 2014).

The Economics Resource Group, Inc.
1998 *American Indian Gaming Policy and its Socio-Economic Effects: A Report to the National Gambling Impact Study Commission*. Cambridge, MA. <http://www.indiangaming.org/library/studies/1004-erg_98rept_to_ngisc.pdf> (accessed on 13 February 2014).

FAO (Food and Agriculture Organization)
2006 Building Adaptive Capacity to Climate Change: Policies to Sustain Livelihoods and Fisheries. *New Directions in Fisheries: A series of Policy Briefs on Development Issues*, No. 08. Rome, Italy. <http://www.fao.org/docrep/010/a1115e/a1115e00.pdf> (accessed on 13 August 2014).

Five Crows, Jeremy
2011 The Nez Perce Tribe Has Combined Traditional Knowledge with State-of-the-Art Science to Create an Innovative Hatchery in the Heart of Their Reservation. *CRITFC, A Lesson from Nature*. <www.critfc.org/wana/hatchery.html> (accessed October 17, 2011).

Folke C., J. Colding, and F. Berkes
2002 Building Resilience for Adaptive Capacity in Social-Ecological Systems. In *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by F. Berkes, J. Colding, and C. Folke. Cambridge University Press, Cambridge, UK.

Fox, Douglas
2007 Back to the No-Analog Future? *Science*, 316(5826):823–825.

Garibaldi, Ann and Nancy Turner
2004 Cultural Keystone Species: Implications for Ecological Conservation and Restoration. Conservation Ecology 8(1).

Galbreath, P.
2011 *Critique of the Prevailing Scientific Paradigm: The Tribal Perspective of Hatchery/Wild Relative Fitness and Relative Reproductive Success Results.* <http://www.critfc.org/vision_conf/presentations/galbreath.pdf> (accessed on 21 August 2011).

Gunderson, Lance. H., and Lowell Pritchard, Jr., editors
2002 Resilience and the Behavior of Large-Scale Systems. Island Press, Washington, D.C.

Harris, Marvin.
1979 *Cultural Materialism: The Struggle for a Science of Culture*. Random House, New York, NY.

Holling, C. S.
1986 The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change. In *Sustainable Development of the Biosphere*, edited by W. C. Clark and R. E. Munn, pp. 292–317. Cambridge University Press, Cambridge, UK.

Langdon, Stephen. J.
2006 Tidal Pulse Fishing. In *Traditional Ecological Knowledge and Resource Management*, edited by C. Menzies, pp. 21–46. University of Nebraska Press, Lincoln.

2007 Sustaining a Relationship. In *Native Americans and the Environment: Perspectives on the Ecological Indian*, edited by M. E. Harkin and D. R. Lewis, pp. 233–273. University of Nebraska Press. Lincoln.

Lewis, David G.
2009 *Termination of the Confederated Tribes of the Grand Ronde Community of Oregon: Politics, Community, Identity*. Doctoral dissertation, University of Oregon, Eugene. University Microfilms International, Ann Arbor, MI.

Lichatowich, James.
1999 *Salmon without Rivers: A History of the Pacific Salmon Crisis*. Island Press, Washington, D.C.

Menzies, Charles R.
2010 Dm sibilhaa'nm da laxyuubm Gitxaała: Picking Abalone in Gitxaała Territory. *Human Organization*, 69(3):213–220.

2012 The Disturbed Environment: The Indigenous Cultivation of Salmon. In *Keystone Nations: Indigenous Peoples and Salmon across the Northern Pacific*, edited by B. J. Colombi and J. F. Brooks, pp. 161–182. School for Advanced Research Press, Santa Fe, NM.

NPPC (Northwest Power Planning Council)
1986 *Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin.* Northwest Power Planning Council, Portland, OR. <http://www.nwcouncil.org/library/1986/Compilation.htm> (accessed on 21 August 2011).

Parry M. L., O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson, editors
2007 *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK. <http://www.ipcc-wg2.gov/AR4/website/fi.pdf> (accessed on 13 February 2014).

Resilience Alliance (RA)
2014 *Adaptive capacity* < http://www.resalliance.org/565.php> (accessed on 13 February 2014).

Smith, Courtland
2012 Introduction: Cultivating Capture Fisheries: Lessons from Salmon Culturing and Cultures. In *Keystone Nations: Indigenous Peoples and Salmon across the Northern Pacific*, edited by B. J. Colombi and J. F. Brooks, pp. 3–24. School for Advanced Research Press, Santa Fe, NM.

Taylor, Joseph, E. III
1999 *Making Salmon: An Environmental History of the Northwest Fisheries Crisis.* University of Washington Press, Seattle.

Trosper, R. L.
2002 Northwest Coast Indigenous Institutions that Supported Resilience and Sustainability. *Ecological Economics*, 41(2):329–344.

2003 Resilience in Pre-Contact Pacific Northwest Social Ecological Systems. *Conservation Ecology*, 7(3):6. <http://www.consecol.org/vol7/iss3/art6/> (accessed on 10 February 2014).

2009 *Resilience, Reciprocity and Ecological Economics: Northwest Coast Sustainability.* Routledge Press, New York, NY.

UNDP (United Nations Development Programme)
2005 *Adaptation Definitions and Levels.* <http://www.undp.org/climatechange/adapt/definitions.html> (accessed on 13 February 2014).

USAID
2009 Adapting to Climate Change: A Guide for Planners. <http://www.crc.uri.edu/download/CoastalAdaptationGuide.pdf> (accessed on 21 August 2011).

Vemuri, A. W. and R. Costanza
2006 The Role of Human, Social, Built, and Natural Capital in Explaining Life Satisfaction at the Country Level: Toward a National Well-Being Index (NWI). *Ecological Economics* 58:119–133.

Walker, Deward E., Jr.
1967 *Mutual Cross-Utilization of Economic Resources in the Plateau: An Example from Aboriginal Nez Perce Fishing Practices.* Washington State University, Laboratory of Anthropology, Pullman.

Walker B. and D. Salt
2006 *Resilience Thinking: Sustaining Ecosystems and People in a Changing World.* Island Press, Washington, D. C.

Ween, Gro and Benedict J. Colombi
2013 Two Rivers: The Politics of Wild Salmon, Indigenous Rights and Natural Resources Management. In Special Issue, Endangered Human Diversity: Languages, Cultures, Epistemologies. *Sustainability*, 5(2):478–495.

Wilkinson, C. F.
2000 *Messages from Frank's Landing: A story of Salmon, Treaties, and the Indian Way.* University of Washington Press, Seattle.

World Bank
2010 *Adaptation Guidance Notes, Key Words and Definitions.* <http://climatechange.worldbank.org/climatechange/content/adaptation-guidance-notes-key-words-and-definitions> (accessed on 21 August 2011).

World Resources Institute (WRI)
2009 *The National Adaptive Capacity Framework: Pilot Draft.* World Resources Institute, Washington, D.C.

ABOUT THE AUTHORS

Benedict J. Colombi, Ph.D. is Associate Professor of the American Indian Studies Program, School of Anthropology, School of Geography and Development, and School of Natural Resources and Environment at the University of Arizona. His specialization lies at the anthropology of complex human-environmental problems. Recent publications include the book, *Keystone Nations: Indigenous Peoples and Salmon across the North Pacific*_and a number of articles and chapters, including long-term and engaged research with the Nez Perce Tribe (*Nimiipuu*) about large dams, salmon, and the regional economy in the Columbia River basin. He also pursues interests in expanding his research to include Southwestern Indigenous people and watersheds; complimented with field studies of Local-Indigenous resources/management in the United States, Canada, Russia, Iceland, Norway, Japan, and Mexico.

Contact: American Indian Studies; Harvill Room 218, PO Box 210076, Tucson, AZ, 85721-0076; bcolombi@email.arizona.edu

Courtland L. Smith, Ph.D. is Emeritus Professor in the Anthropology Program, School of Language, Culture, and Society, Oregon State University. He is an anthropologist, educator, and scientist who studies how human values, culture, and history affect ecological and economic issues. He joined the Department of Anthropology at Oregon State University in 1969 and is the author of several articles in scientific journals and general interest publications, books, and monographs.

Contact: Anthropology, 238 Waldo Hall; Oregon State University; Corvallis, OR 97331

---

[i] Billy Frank, Jr., the most noted and inspiring tribal leader on Pacific Northwest salmon issues, passed away on May 5, 2014.