A woman sifts the sand for gold on the Irrawaddy River, Myanmar. Photo by International Rivers.

Project Assessment: Once Projects Are Chosen

Once plans and feasibility studies have been completed, dams usually receive project-level assessments that will inform the creation of project-level managementplans. If a dam is to be built, it requires high standards of project-level risk assessment. This assessment should be developed using the best available tools at the multiple scales at which risks and impacts will occur.

In this chapter, we will describe how dam impacts are assessed, and a number of the most significant impacts caused by large dams: biodiversity, displacement, and water quality.

Environmental and Social Impact Assessment

A Environmental and Social Impact Assessment (ESIA) assesses the project's social and environmental impacts. It clearly describes project alternatives, including the alternative of "no project." The ESIA should fit directly within and meet the conditions of the Strategic Environmental Assessment (SEA) and Energy and Water Resources plans, referenced earlier in this document.

This is where the rubber meets the road for the dam developer and financier. The ESIA must adequately assess all potential risks associated with project construction, implementation, and operation. ESIAs differ from Strategic Environmental Assessments (SEAs) in that ESIAs are of more limited scope, often only including impacts within a smaller project-level area. In contrast, an SEA assesses the social and environmental impacts of a project within a broader spatial and temporal scale, such as a river basin. Projects that have no relation to an SEA often lead to the development of a very limited ESIA, in which broader risks and considerations may be ignored.

To hold a developer accountable to human rights, specific assessments that measure compliance of the developer with international human rights laws and national laws should be carried out as part of the ESIA. These include but are not limited to a Human Rights Impact Assessment, a Gender Impact Assessment, and an Indigenous Peoples' Impact Assessment.

Human Rights Impact Assessment

The rationale for a human rights impact assessment is described in *Section I: Rights Across All Stages*. But what does a human rights impact assessment look like in practice? Below are links to some examples of human rights impact assessment methodologies and outcomes:

- Download and use a Human Rights Impact Assessment Toolkit from Nomogaia: http://nomogaia.org/tools/
- See examples of a Human Rights Impact Assessment, from Nomogaia: http://nomogaia.org/work/
- Read a "Rights and Democracy Guide to Human Rights Impact Assessments" at: http://equalit.ie/content/human-rights-impact-assessment-tool
- Read the IFC's "Guide to Human Rights Impact Assessment and Management: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_handbook_hria__wci__1319577931868

Gender Impact Assessment

Similarly, the rationale for a gender impact assessment is described in *Section I: Rights Across All Stages.* Below are some examples of what a gender impact assessment looks like:

- Read Oxfam Australia's "Manual on Gender Impact Assessment and Hydropower": www.oxfam.org.au/giamanual
- Read the European Commission's "Guide to Gender Impact Assessment:" http://ec.europa.eu/social/BlobServlet?docId=4376&langId=en
- Read Women Enterprise and Employment in local Development's "Gender Impact Assessment Toolkit": http://urbact.eu/uploads/tx_projectsresultsdocuments/WEED_Gender_Impact_Assessment_Toolkit.pdf

Indigenous Peoples' Impact Assessment

Finally, the rationale for an indigenous peoples' impact assessment is also described in *Section I: Rights Across All Stages*. Below are some examples of policies on how to do indigenous peoples' impact assessments:

- Read the IFC's Performance Standard 7 on Indigenous People: http://www.ifc.org/wps/wcm/connect/1ee7038049a79139b845faa8c6a8312a/PS7_English_2012.pdf?MOD=AJPERES
- Read the World Bank's OP4.10 Annex B, Indigenous Peoples Plan: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTOP MANUAL/0,,contentMDK:20564712~menuPK:4564185~pagePK:64709096~piPK:64709108~theSitePK:502184,00.html

All types of impacts of dam projects are important to assess. A full description of all these areas is beyond the scope of this publication; however, below are descriptions of three significant areas of dam impacts – Biodiversity, Water Quality, and Displacement and Resettlement – and descriptions of useful standards to promote.

Typical Timing and Scope of an ESIA

ESIAs are intended to inform the design of the project, so they need to be completed during the design phase & definitely before construction begins. Ideally, an ESIA should be conducted with public participation. A draft should be made available to the public for comment before it is finalized.

Usually, ESIAs are structured in the following way:[75]

- An executive summary
- A discussion of the policy, legal and administrative framework of the project
- A project description
- Baseline data
- Environmental and social impacts
- An analysis of alternatives
- An Environmental Action Plan (EAP)
- Appendices, including:
  - A list of the preparers of the EIA
  - References of written, published and unpublished material used in the preparation of the EIA
  - A record of interagency and consultation meetings, including consultations for obtaining the informed views of the affected people and local non-governmental organizations. The record specifies any means other than consultations (e.g. surveys) that were used to obtain the views of affected groups and NGOs.
  - Tables presenting the relevant data referred to or summarized in the main text.

However, too frequently, ESIAs are treated as mere formalities, or obstacles in the path to project approval. EIA experts often note that project developers compile ESIAs that present significant gaps in information, due to political pressure to hasten environmental approval. Such ESIAs fail to accurately assess the full risk factors that a project may present to both affected communities, the environment, and project developers and financiers.

For dams, a number of topics are of utmost importance for social and environmental assessment. If these topics are missing from an ESIA, it is an indication that the assessment is poor.

- Displacement of Affected People
- Impacts on Biodiversity
- Impacts on Forests and Vegetation
- Impacts on Aquatic Species
- Sedimentation
- Water Quality
- Water Quantity, Abstraction, Withdrawal
- Cultural Heritage and Property
- Health Impacts
- Gender Impacts and Impacts on Women
- Cumulative, Indirect, and Interactive Impacts
- Trans-boundary Impacts

Grievance Mechanisms and Accountability

The existence of a grievance mechanism is a central tenet of a human rights impact assessment, and is an important part of risk management, stakeholder engagement, and the relations between a dam developer, government, and dam-affected communities. The existence of a grievance mechanism allows dam-affected people to seek access to justice, remedy, and reparations, as recognized and protected by international human rights law.

For a grievance mechanism to operate successfully, project-affected communities must enjoy access to information, information must be made available in culturally-appropriate forms and in the language of the community, and the mechanism must be designed according to community wishes, rather than those of the developer. Grievance mechanisms allow affected people another avenue to hold project developers and financiers accountable to wrongdoings or poor outcomes.

Certain industry players are increasingly turning to the implementation of human rights assessments as an effective way to do sustainable business; dam builders who hear communities' grievances and respect their rights often have improved stakeholder relations. Those communities who track developers' efforts in creating and implementing a grievance mechanism will be able to influence audits of mitigation actions, and may ultimately achieve better outcomes from the developer or operator *(see Section V, Project Impact Management: Once Projects Begin).*

FURTHER READING:

- Read the International Association for Impact Assessment's resources list on ESIA: http://www.iaia.org/publications-resources/downloadable-publications.aspx
- Read the IFC's Performance Standard 1 on Assessment and Management of Environmental and Social Risks and Impacts: http://www.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES
- Read the EBRD's manual on Environmental and Social Impact Assessment: http://www.ebrd.com/environment/e-manual/r16eia.html
- Read the UNECE Convention on Environmental Impact Assessment in a trans-boundary Context: http://www.unece.org/env/eia/eia.html

IDEAS FOR ACTION:

- Based on the sample tools listed above, create your own community-based assessment for any of these topic areas. Demand that the dam developer include your community-based assessment in the project ESIA. If it is not included, publish your community-based assessment in local, regional, and international media, to draw attention to discrepancies.

The following sections describe some of the most significant impacts caused by dams, and the institutions and norms that can be utilized to promote best practices in project assessment.

Biodiversity

Dams often have large, and sometimes irreversible impacts on ecosystems and biodiversity. Both aquatic and terrestrial species provide economic, cultural, nutritional, social, recreational and spiritual benefits to human populations. As a result, you should call on dam developers and financiers to adhere to the strongest standards in biodiversity conservation.

Biodiversity conservation generally includes the protection of two types of biodiversity: aquatic biodiversity, which generally refers to species that depend on the environmental flow regimes of rivers, lakes, and wetlands for survival and reproduction, and terrestrial biodiversity, which generally refers to species that depend on land habitats.

A number of international covenants exist that lay out commitments for biodiversity conservation. These are the Convention on Biological Diversity (CBD), the Ramsar Convention, the UNECE Water Convention, and the UN Fish Stocks Agreement.

The Convention on Biological Diversity

The Convention on Biological Diversity (CBD) was opened for signature in 1992 and the United Nations Earth Summit in Rio de Janeiro. The CBD has three objectives: the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources76. As of 2013, there are 193 parties to the CBD.

Article 8 of the Convention on Biological Diversity promotes the establishment of in-situ and ex-situ areas of protection for biodiversity conservation. In-situ refers to the conservation of species in the natural habitat in which they are found. Article 9 of the Convention on Biological Diversity promotes the establishment of facilities for the ex-situ conservation of components of biological diversity.

Article 10 of the CBD promotes the sustainable use of biodiversity through integrating "consideration of the conservation and sustainable use of biological resources into national decision-making."

Article 14 of the CBD promotes the requirement of an environmental impact assessment of proposed projects *"that are likely to have significant adverse effects on biological diversity, with a view to avoiding or minimizing such effects."*

The Ramsar Convention

The Ramsar Convention or Convention on Wetlands of International Importance promotes national action and international cooperation for the conservation and wise use of wetlands and their resources.[77] The convention established a List of Wetlands of International Importance, which promotes their conservation. As of 2013, there are 168 contracting parties.

An important facet of the Ramsar Convention is the **conservation of wetlands and compensation for loss of wetlands.** Articles 3 and 4 of the Ramsar Convention promote implementing planning so as to promote the conservation of the wetlands included in the list, and as far as possible the wise use of wetlands in their territory. In the case of loss of wetlands, the articles promote compensation as far as possible for any loss of wetland resources, and in particular the

A Word on Biodiversity Offsets

Often, the impacts caused by dams are justified by project developers and financiers through the creation of biodiversity offsets. Offset refers to a practice of compensation through exchange, and is the last available option in any project-level mitigation hierarchy *(see Section V, Project Impact Management: Once Projects Begin)*. In general, a biodiversity offset allows certain biodiversity impacts generated by a dam to occur in one place, in exchange for the protection of other biodiversity assets located in a different place.Offsets are often temporary and governments can change their mind in the future; as a result, offsets should be utilized only as a method of last resort, once all mitigation options have been exhausted.

creation of additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat.

The UNECE Water Convention

Protection and Use of Trans-boundary Watercourses and International Lakes The UNECE Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes, or the Water Convention, is applicable to European Union member countries. It "obliges Parties to prevent, control and reduce trans-boundary impact, use trans-boundary waters in a reasonable and equitable way and ensure their sustainable management. Parties bordering the same trans-boundary waters shall cooperate by entering into specific agreements and establishing joint bodies. The Convention includes provisions on monitoring, research and development, consultations, warning and alarm systems, mutual assistance, and exchange of information, as well as access to information by the public." The UNECE Water Convention entered into force on February 6th, 2013. You can check the status of country ratification on its website.[78]

The UN Fish Stocks Agreement

The United Nations Convention on the Law of the Sea Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, or simply, The UN Fish Stocks Agreement, promotes the maintenance of freshwater fisheries. The UN Fish Stocks Agreement "sets out principles for the conservation and management of those fish stocks and establishes that such management must be based on the precautionary approach and the best available scientific information. The Agreement elaborates on the fundamental principle, established in the Convention, that States should cooperate to ensure conservation and promote the objective of the optimum utilization of fisheries resources both within and beyond the exclusive economic zone." The UN Fish Stocks Agreement has been in force since December 11th, 2001, and as of 2013, has 166 ratifying parties.[79]

Case Study: The Inter-American Development Bank's "River Offset" for the Reventazón Hydropower Project, Costa Rica

One example of biodiversity offsets related to a dam project is the "river offset" planned for the Reventazón Hydropower Project in Costa Rica. The Reventazón Dam is a 305.5 MW hydropower project partially financed by the Inter-American Development Bank (IADB). The project's 8-kilometer long reservoir will interrupt the habitat connectivity of the Central American jaguar, cutting through the Barbilla Destierro Biological Sub-corridor, a critical pathway for jaguars along Costa Rica's Volcánica Central Talamanca Biological Corridor and for the Mesoamerican Biological Corridor as a whole.

In addition, the Reventazón Dam, together with the already existing Cachi Dam, will create cumulative impacts on three migratory fish species, reducing their ability to reproduce.

In order to mitigate the project's impacts on biodiversity, the dam's action plans foresee the creation of a "river habitat offset." This offset seeks to permanently protect the Parismina River, which joins with the Reventazón on the coastal plain, by prohibiting any artificial modifications on the Parismina, including dams that would block migrations. Accordingly, the Parismina's natural flow pattern and its biological integrity will be preserved or restored where required.

FURTHER READING:

- Read the text of the Convention on Biological Diversity: http://www.cbd.int/convention/text/
- See who has ratified the Ramsar Convention at the UNESCO site: http://www.unesco.org/eri/la/convention.asp?KO=15398&language=E&order=alpha
- Access the UN Fish Stocks Agreement: http://www.un.org/depts/los/convention_agreements/convention_overview_fish_stocks.htm
- Read about The Inter-American Development Bank's Biodiversity Platform: http://www.iadb.org/biodiversity

IDEAS FOR ACTION:

- Based on the resources listed above, create your own community-based biodiversity assessment. Demand that the dam developer include your community-based assessment in the project ESIA. If it is not included, publish your community-based assessment in local, regional, and international media, to draw attention to discrepancies.

Water Quality

Dams often lead to poor water quality, upstream, inside the reservoir, and downstream from the impoundment. Here is a summary of the kinds of water quality problems that arise when a river is dammed, which need to be assessed and mitigated.

Temperature

Water released from deep in a reservoir behind a high dam is usually cooler in summer and warmer in winter than river water, while water from outlets near the top of a reservoir will tend to be warmer than river water all year round. Warming or cooling the natural river affects the amount of dissolved oxygen and suspended solids it contains and influences the chemical reactions which take place in it. Altering natural seasonal changes in temperature can also disrupt the life-cycles of aquatic creatures – breeding, hatching and the metamorphosing of larvae, for example, often depend on thermal cues.

Relatively warm winter releases from reservoirs in cold climates will inhibit the formation of ice downstream. Reduced ice cover makes hazardous or impossible the use of frozen rivers as winter roads: in northern Scandinavia, for example, dams mean that the Sami people can no longer use many of their traditional winter reindeer herding routes which follow frozen rivers. Cold winter air passing over the relative warmth of some of the huge Russian and Canadian reservoirs can cause long spells of freezing fog.

Sedimentation

In the same way as reservoirs trap river sediment, they also trap most of the nutrients carried by the river. During warm weather, algae are likely to proliferate near the surface of a highly nutrient-enriched, or eutrophic, reservoir. Through photosynthesis the algae consume the reservoir nutrients and produce large amounts of oxygen. Summer releases from the surface layer, or epilimnion, of a reservoir will thus tend to be warm, nutrient-depleted, high in dissolved oxygen, and may be thick with algae. High levels of algae can provide food for fish but also give water an unpleasant smell and taste, clog water supply intakes, coat gravel beds and restrict recreation. Massive algal blooms in shallow, stagnant reservoirs can rendered water unfit for either household or industrial use.

When algae in a reservoir die they sink to its bottom layer, or hypolimnion, where they decay, a process that consumes the already limited hypolimnion oxygen (there is usually not enough light for photosynthesis at the bottom of a reservoir). The acidity of this oxygen-depleted water often renders it capable of dissolving minerals, such as iron and manganese, from the lake bed. Warm weather releases from a dam with low-level outlets will thus be cold, oxygen-poor, nutrient-rich and acidic, and may contain damagingly high mineral concentrations. The presence of an adequate level of dissolved oxygen in a river is one of the main indicators of good water quality. Water poor in dissolved oxygen can "suffocate" aquatic organisms and make water unfit to drink. Dissolved oxygen, furthermore, is vital to enable bacteria to break down organic detritus and pollution.

Nutrient Loading

Dams can lead to decreased sedimentation in rivers. As rivers move downstream, sediments carried by the river will accumulate behind a dam wall, and can sink to the bottom where they accumulate. Sediments may contain nutrients such as nitrogen, phosphorus, and others, which change the water quality and pH of a reservoir. This process is called nutrient loading: an increase in nutrient concentration that changes the chemistry and quality of the water.

Nutrient loading can also occur due to existing land use both in the flooded area and in surrounding lands. When a reservoir floods land that contains vegetation that has not been removed, the vegetation will decompose and produce an anoxic environment in the reservoir. Similarly, surrounding intensive land uses, such as plantations or industrial agriculture, increase the deposition of nutrients into a river. In cases where a reservoir is surrounded by large agriculture production, the extra nutrient loading can lead to a highly polluted reservoir.

Reservoir Emissions

During the first years after a reservoir is filled the decomposition of submerged vegetation and soils can drastically deplete the level of oxygen in the water. Rotting organic matter can also lead to releases of huge amounts of the greenhouse gases methane and carbon dioxide. Reservoirs often "mature" within a decade or so, although in the tropics it may take many decades or even centuries for most of the organic matter to decompose. Thorough clearing of vegetation in the submergence zone before the reservoir is filled can reduce this problem, but because it is difficult and prohibitively expensive, especially for large reservoirs, this is only ever partially done at best. Also, vegetation clearing does not necessarily remove GHG emissions, since vegetation can still enter the reservoir through runoff. Eutrophication from upstream fertilizer runoff can also increase reservoir biological productivity and decay.

Reservoir Flooding at the Brokopondo Dam, Suriname

Some of the most notorious examples of the large-scale flooding of forest have occurred in South America. Brokopondo Dam in Suriname submerged 1,500 square kilometers of rainforest – 1% of the country. The decomposition of the organic matter in its shallow reservoir severely deoxygenated the water and caused massive emissions of hydrogen sulphide, a corrosive and foul-smelling gas. Workers at the dam had to wear masks for two years after the reservoir started to fill in 1964. The cost of repairing damage done to Brokopondo's turbines by the acidic, deoxygenated water was estimated in 1977 to have totaled $4 million, more than seven per cent of the total project cost. Studies carried out in 1967 showed that oxygen levels in the river only began to recover around 110 km downstream of the dam, depriving many riverside communities of drinking water and fish.

Reservoir Flooding at the Tucuruí and Balbina Dams, Brazil

Despite a legal requirement to clear vegetation from all areas to be submerged, the Brazilian electricity utility Eletronorte cleared less than a fifth of the 2,250 square kilometers of rainforest inundated by Tucuruí and only a token 2% of the 3,150 square kilometers of forest inundated by Balbina Dam. Clearing all of the Tucuruí reservoir would have increased the project's cost by an estimated $440 million. Because Balbina's turbine intakes are at the very bottom of the 50 meter high dam, the Uatumã River, a north-bank tributary of the Amazon, is receiving almost totally deoxygenated water from the reservoir.

Liquid Effluents

Hydropower turbines and other machinery involved in a dam require oils in order to maintain viscosity and lubrication. These oils are often leeched into the river downstream, and can contaminate both water quality and soil quality.

Wastewater can also be produced at dam construction and operation sites. Wastewater treatment plants should be built at the dam site.

Invasive Species

Nutrient-enriched tropical reservoirs are particularly prone to colonization by aquatic plants. Mats of floating plants can impede fishing boats and nets, block out light for other organisms, clog turbines and provide an excellent habitat for disease vectors such as mosquitoes and the snails which host the schistosomiasis parasite. Through transpiration, aquatic plants can also lower reservoir levels: losses of water from evaporation and transpiration in weed-covered reservoirs can be up to six times higher than those from evaporation in open waters.

Reservoir operators' most dreaded weed is the water hyacinth (*Eichhornia crasspipes*), a native of Amazonia which is now found throughout the tropics. Water hyacinths can proliferate at an extraordinary rate in eutrophic reservoirs, largely stymying efforts to eradicate them by physically removing the plants or by spraying them with herbicides (which brings its own problems).

Mercury Methylation

Scientists have only relatively recently become aware of what now appears to be a pervasive reservoir contamination problem, the accumulation of high levels of mercury in fish. Mercury is naturally present in a harmless inorganic form in many soils. Bacteria feeding on the decomposing matter under a new reservoir, however, transform this inorganic mercury into methyl mercury, a central nervous system toxin. The methyl mercury is absorbed by plankton and other creatures at the bottom at the aquatic food chain. As the methyl mercury passes up the food chain it becomes increasingly concentrated in the bodies of the animals eating contaminated prey. Through this process of bioaccumulation, levels of methyl mercury in the

Invasive Species in Reservoirs

Two years after Brokopondo began to fill, over half its reservoir was covered with water hyacinth. The plant was partially brought under control by a long-term program of aerial spraying with the carcinogenic herbicide 2,4-D which also poisoned many other plants and animals. African reservoirs have also suffered serious infestations of water hyacinths and other plants. At one point a fifth of the surface of Kariba Reservoir – more than 1,000 square kilometers – was smothered by aquatic plants.

Methyl Mercury in the La Grande Dam Reservoir, Quebec

The best researched case of reservoir methylmercury is at the La Grande hydroelectric complex in Quebec, part of the huge James Bay Project. Ten years after the La Grande 2 Reservoir was first impounded, mercury levels in pike and walleye had risen to six times their pre-reservoir level and showed no signs of leveling off. As these fish are a major part of the traditional diet of the local Cree native people, mercury levels in their bodies have risen dangerously. By 1984, six years after La Grande 2 Dam was completed, 64% of the Cree living on the La Grande estuary had blood mercury levels far exceeding the World Health Organization tolerance limit.

tissues of large predatory fish at the top of the reservoir food chain can be several times higher than in the small organisms at the bottom of the chain.

Evaporative water losses

Because they greatly multiply the surface area of water exposed to the rays of the sun, dams in hot climates can lead to the evaporation of huge amounts of water which is mainly lost to the river downstream. In the region of 170 cubic kilometers of water evaporates from the world's reservoirs every year, more than seven per cent of the total amount of freshwater consumed by all human activities. The annual average of 11.2 cubic kilometers of water evaporated from Nasser Reservoir behind the High Aswan Dam is around 10% of the water stored in the reservoir and is roughly equal to the total withdrawals of water for residential and commercial use throughout Africa.

Relevant Policies:

- The United States' National Guidance on Water Quality Standards for Wetlands: The United States' Water Quality Standards Regulation (40 CFR 131.11(a)(1)) requires U.S. states to adopt criteria sufficient to protect designated uses. These criteria may include general statements (narrative) and specific numerical values (i.e., concentrations of contaminants and water quality characteristics). At a minimum, the U.S. Environmental Protection Agency expects states to apply aesthetic narrative criteria (the "free forms") and appropriate numeric criteria to wetlands and adopt narrative biological criteria for wetlands. Most state water quality standards already contain many criteria for various water types and designated use classes, including narrative criteria, and numeric criteria to protect human health and freshwater and saltwater aquatic life, that may be applicable to wetlands.
- ISO 13.060: Water quality: ISO 13.060 consists of ten policies that describe technical standards in areas such as toxicity, biodegradability, protection against pollution, related installations and equipment. Specific areas in these policies include: water of natural resources; drinking water; chemicals for purification of water, see; drinking water supply systems; water for industrial use including water for commercial use and fish breeding; sewage water disposal and treatment; drainage systems; sampling; examination of water for chemical substances; physical properties of water; biological properties of water; and others.
- The IFC's Environment, Health, and Safety Guideline on Wastewater and Ambient Water Quality: The guideline covers matters related to surface water, sewage systems, industrial wastewater, emissions from wastewater treatment, and others.

Salinity in the Colorado River, United States

The massive amounts of evaporation from the reservoirs behind Hoover and the other dams on the Colorado – one third of the river's flow is evaporated from reservoirs – is one of the reasons why the salinity of the river has risen to damaging and costly levels. High salt concentrations are poisonous to aquatic organisms and they corrode pipes and machinery: the increased Colorado River salinity costs Southern California's water users millions of dollars each year.

Soils are often naturally saline in arid areas like the US West and are made even saltier when irrigated. Irrigation water percolates through the soils, picking up salts, then returns to the river. On rivers like the Colorado the same water may be used for irrigation 18 times over. Reservoir evaporation concentrates further the level of salt in the river. The salinity of the water at Imperial Dam, just north of the Mexican border, increased from an average of 785 parts per million (ppm) between 1941 and 1969, to over 900 ppm in 1990. It is predicted to exceed 1,200 ppm after the year 2000. The US standard for drinking water is 500 ppm.

In the early 1960s, a surge in salt levels caused a dramatic decline in yields on fields irrigated with Colorado water in Mexicali, one of Mexico's most productive agricultural regions. Mexico City made a formal protest to Washington, DC, and finally in 1974 the two countries signed an agreement under which the salinity of the Colorado River at the Mexican border must not exceed 1024 ppm. The Bureau of Reclamation's "salinity control program," initiated after the treaty with Mexico, had cost taxpayers $660 million by 1993. The centerpiece of the program is a money-sucking, technological non-fix – one of the world's largest and most expensive desalination plants. The plant, built at Yuma, Arizona, cost $256 million. It began operation in May 1992, but was closed again in January 1993 after floods destroyed some of the drains bringing it saline water. "In a region covered with water-reclamation projects of fabulous expense and questionable usefulness," wrote Martin Van Der Werf in the Arizona Republic, "the Yuma plant may be the biggest laughingstock of all."

FURTHER READING:

- Read the United States' Water Quality Standards Handbook: http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm
- Access the ISO Standards Catalogue on Water Quality: http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_ics_browse.htm?ICS1=13&ICS2=60
- Read the IFC's Environment, Health, and Safety Guideline on Wastewater and Ambient Water Quality: http://www.ifc.org/wps/wcm/connect/026dcb004886583db4e6f66a6515bb18/1-3%2BWastewater%2Band%2BAmbient%2BWater%2BQuality.pdf?MOD=AJPERES

IDEAS FOR ACTION:

- Based on the resources listed above, create your own community-based water quality assessment. Demand that the dam developer include your community-based assessment in the project ESIA. If it is not included, publish your community-based assessment in local, regional, and international media, to draw attention to discrepancies.

Displacement, Resettlement and Benefit Sharing

Dams can change the livelihoods of those people affected by them in radically negative ways, literally uprooting families from their homes and established methods of economic survival. The effects of displacement are often magnified among traditional and indigenous communities, who have long-established land-based cultures and relationships. Downstream communities have traditionally been left out of the equation, and this is not acceptable.

A number of rights are prescribed to protect affected communities against displacement and during the process of resettlement. These include:

The Right to Place-Based Livelihoods

As stated earlier, the Right to Housing and the Right to Culture are universal human rights promoted in international law. This means that affected people have the right to place-based livelihoods. A place-based livelihood may be defined as the intimate relation of a population to its territory, land, and resources found there.

The right to place-based livelihoods is expressed as a right of Indigenous Peoples by Article 10 of UNDRIP, which states: *"Indigenous peoples shall not be forcibly removed from their lands or territories. No relocation shall take place without the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return."*[80] Articles 11-14 may also be interpreted as relating to indigenous peoples' cultural relations to territory and land.

Access to Information, Consultation and Active Participation in Decision-Making

Any affected community that will be displaced and/or resettled has the right to complete access to information, consultation, and active participation in decision-making, as outlined earlier in this document.

Forced Evictions and the Right to Adequate Housing

The UN Basic Principles and Guidelines on Development-based Evictions and Displacement[81] broadly defines the obligation of States and project-related stakeholders to refrain from, and protect against, forced evictions from home(s) and land. This obligation arises from several international legal instruments that protect the human right to

Case Study: Displacement and Resettlement at the Three Gorges Dam, China

China's Three Gorges Dam is one of the largest infrastructure projects ever created. Reflecting its size, its impacts on the livelihoods of affected people have been immense. Before construction began, one of the largest resettlement programs in the history of humankind was undertaken. All in all, it is estimated that at least 1.3 million people were involuntarily displaced and resettled due to the Three Gorges Dam.

The resettlement program was plagued with problems. There was falsification of information in the assessment. Criticism of resettlement programs was banned, and the participation of affected people in the creation and management of the programs was not allowed. Resettled people often cited coercion by the program managers, and poor compensation. Overall, critics say that improvement of livelihoods did not materialize through the resettlement programs, while there is a dearth of suitable arable land for those resettled.

Today, geological hazards produced by the reservoir levels still endanger resettled communities and have forced many to be resettled a second or third time.

For more information, see:

- http://www.unhcr.org/refworld/country,,HRW,,CHN,4562d8cf2,3ae6a7d310,0.html
- http://www.hrichina.org/sites/default/files/oldsite/fs/downloadables/pdf/downloadable-resources/three_gorges_98.pdf
- http://www.internationalrivers.org/files/attached-files/3gcolor.pdf
- http://www.internationalrivers.org/node/7642

adequate housing and other related human rights, as defined by the Universal Declaration of Human Rights, Article 25.

General Comments 4 on The Right to Adequate Housing and 7 on The Right to Adequate Housing: Forced Evictions (art.11 (1), of the Committee on Economic, Social and Cultural Rights (CESCR), protect project-affected communities' rights to adequate housing as defined by the Universal Declaration of Human Rights, Article 25.

Livelihood Improvement and Benefit Sharing

Benefit sharing may take multiple forms. In general, dam developers should fully restore lost livelihoods and ensure that affected people are "better off" than before. Dam-affected people should record the economic, social, cultural, religious, environmental, and any other values that they enjoy and feel they will lose as a result of the dam, in order to identify and illustrate what "better off" means to them. This information may conflict with what is recognized by the dam developer; as a result, documentation is important.

In the case that dam-affected communities are removed from land, they should have the right to obtain **land-for-land compensation** – meaning that the land they receive is equal to or better in both quality and quantity to the land previously owned or occupied.

Such benefits should be prepared in a **benefit-sharing plan,** which details how the developer will restore or improve the lost livelihoods of dam-affected people. Common areas to pay attention to include land-for-land compensation; access to in-kind or improved labor opportunities; improved health and education services; access to employment and job training, and guaranteed access to energy and electricity.

Affected communities should also have the right to negotiate **legally-enforceable contracts**, rather than make informal agreements, related to their process of resettlement, compensation, and benefit-sharing.

Finally, affected communities should have the right to **participate in the supervision, monitoring, and evaluation** of resettlement programs.

Relevant Policies:

- UN Basic Principles and Guidelines on Development-based Evictions and Displacement. These principles are non-binding, but are a restatement of binding international law.
- General Comments 4 on The Right to Adequate Housing and 7 on The right to adequate housing: forced evictions (art.11 (1) of the Committee on Economic, Social and Cultural Rights (CESCR)
- IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement

FURTHER READING:

- Read and use the Housing and Land Rights Network's eviction impact assessment tool: http://www.hlrn.org/spage.php?id=p2s=#.UcwSWj5gb6k.

IDEAS FOR ACTION:

- Contact the national office of the UN Human Settlements Programme (UN-Habitat) in your country. http://www.unhabitat.org/categories.asp?catid=22
- Based on the resources listed above, create your own community-based displacement and resettlement assessment. Demand that the dam developer include your community-based assessment in the project ESIA. If it is not included, publish your community-based assessment in local, regional, and international media, to draw attention to discrepancies.