



*When a habitat is impacted by a chemical or oil spill, Habitat Equivalency Analysis (HEA) is often used to quantify the injuries to natural resources and to identify an ecological restoration project that, when implemented, will compensate the public for the injury.*



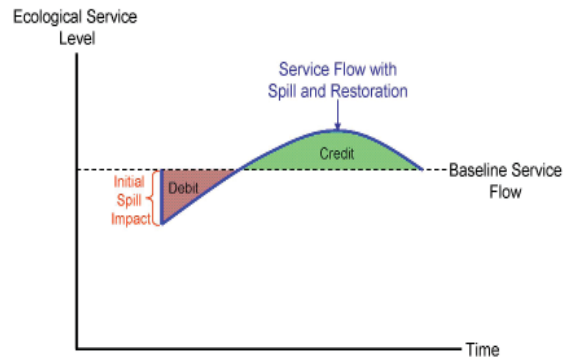
### Technical Underpinnings:

HEA is a simplified economic model of compensation. It simultaneously assesses all of the services flowing from a habitat type using a three step process:

1. The level of habitat service that would have been provided if the spill had not occurred is projected through time (baseline).
2. The level of habitat service that will be provided given the spill and some ecological restoration project is projected through time.
3. The size of the ecological restoration project is adjusted until society experiences no net loss of service flowing from the habitat.

As discussed below, HEA is often discussed in terms of “debits” and “credits”. When the “with-spill-and-restoration” service level is below baseline, a debit accumulates. When the with-spill-and-restoration service level exceeds baseline, a credit accumulates. The public is compensated

(i.e. the restoration project is “scaled”) when the present value of the debit is equal to the present value of the credit.



The HEA metric is often the Discounted Service Acre Year (DSAY). A Service Acre Year (SAY) represents all of the services flowing from an acre of habitat. Services are discounted to reflect society’s preference to have things sooner rather than later all else being equal. When the number of DSAYs provided under the baseline condition (i.e., without the spill) is equal to the number of DSAYs provided with-spill-and-restoration, compensation is achieved.

While these concepts appear straight forward, there are a number of complications that arise in practice. Differences in the details of implementation and approach can mean millions of dollars of National Resource Damage Assessment (NRDA) liability.

ENTRIX has developed a library of HEA applications, both published and in the grey literature. These applications generally reflect HEA methods developed cooperatively with state and Federal Trustees. Access to extensive practical experience and our wide array of past applications coupled with automated HEA calculators allows ENTRIX to rapidly identify the likely range of restoration that will be identified by HEA. This in turn helps RPs develop strategies for managing potential NRD liability.

### Applications:

- **HEA for Rocky Intertidal and Rip-rap Habitats.** Working cooperatively with NOAA, USFWS, California Office of Spill Prevention and Response (OSPR), Massachusetts Executive Office of Environmental Affairs (EOEA), Louisiana’s Oil Spill Coordinators Office (LOSCO), Texas General Land Office (GLO) and a host of tribes and state agencies from around the country, ENTRIX has conducted HEAs to quantify the amount of restoration that, when implemented, will offset the impacts of chemical and oil spills on rocky intertidal habitats in both fresh and salt water. By introducing science in the form of site-specific

# Habitat Equivalency Analysis

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monitoring and literature describing habitat recovery, ENTRIX ensures that the assumptions embedded in the analysis are consistent with the actual facts of the spill. The use of habitat conversion factors allows the debit associated with impacts to these habitats, which are difficult to create and/or restore, to be offset by cost effective projects such as wetland creation and/or rip-rap removal/restoration.

- **HEA for Wetland Habitats.** Working cooperatively with NOAA, USFWS, OSPR, tribes and state agencies from around the country, ENTRIX has used HEAs to quantify the amount of restoration required to offset the impacts of wetland burning, wetland trampling, and the introduction of chemicals or oil to both fresh and salt water wetlands. When wetland compensation is evaluated using HEA, it is common practice to estimate restoration requirements associated with impacts to the animals that reside in the wetland using separate methods. When these multiple approaches are applied to a single release the restoration requirements estimate by the two approaches are generally not additive and a careful accounting of individual ecological services can reduce NRDA liability by millions of dollars relative to the simple assumption of additivity.
- **HEA for Forested Fen.** ENTRIX conducted a HEA to scale compensatory restoration for impacts to forested fen habitat. Given the extended time periods and unique conditions required for the development of fen habitat (these freshwater wetlands develop mineralized soils over hundreds of years), the habitat equivalency analysis utilized a habitat conversion factor to scale restoration to habitats that could be readily created via habitat restoration. By applying a common tool to this unique habitat, ENTRIX allowed the Responsible Party (RP) and state agencies to proceed through an assessment that otherwise appeared intractable.
- **HEA for Upland Forest and Riparian Habitats.** ENTRIX has conducted HEAs to scale compensatory restoration for impacts to upland forest areas, freshwater riparian corridors and saltwater riparian corridors. The level of impact evaluated has ranged from chronic low level exposure to one time events resulting in the loss of all trees, vegetation, and top soil. The extended time periods associated with the complete development of forested habitats requires a careful accounting of all services including the vast majority of those that return relatively rapidly following the re-establishment of vegetation. ENTRIX has found that, by focusing the cooperative assessment process on the individual services flowing from these habitats, the scientific defensibility of each assessment is increased and estimated compensatory requirements are generally decreased.
- **HEA for Sub-aqueous Habitats.** Working cooperatively with NOAA, USFWS, OSPR, MA EOEA, LOSCO and a host of tribes and state agencies from around the

country, ENTRIX has conducted HEAs to assess the impacts of chemical and oil spills on sub-aqueous habitats ranging from the deep water sediments of the Gulf of Mexico to the intertidal habitats of Washington state, to the headwaters of Appalachian rivers. While these HEAs can simultaneously address potential impacts to a wide range of species and substrates, the added complexity can require a wide range of experienced NRDA professionals including benthic ecologists, hydrogeologists, ecotoxicologists, and fisheries biologists. ENTRIX is one of the few companies with a proven track record of using HEA to successfully evaluate NRDA in such complex environments.

- **HEA for Reef Habitats and Seagrass Beds.** When reefs or seagrass beds are impacted by chemical spills, oil spills, and/or groundings, impacts may extend beyond the individual corals, oysters, or seagrass to the entire reef or seagrass community. When this occurs, ENTRIX has worked cooperatively with Federal and state Trustee agencies to quantify the amount of restoration required to offset injuries to the ecosystem. These assessments often incorporate differential development of individual corals, oysters or grasses and the development of the ecological communities they support.

## Representative HEA Related Publications:

- Wakefield, Tomasi, Webber, Byrd, and Harmon. 2009. Evaluation and Comparison of Habitat and Resource Equivalency Models. Submitted to the API. Washington D.C., 126 pp.
- Wakefield, Tomasi, and Harmon. 2009. ENTRIX Inc. Comments on the Draft Damage Assessment and Restoration Plan for the Athos oil spill. Available at: [http://www.darrp.noaa.gov/northeast/athos/pdf/Integrated\\_Athos\\_Comments\\_Final\\_021909.pdf](http://www.darrp.noaa.gov/northeast/athos/pdf/Integrated_Athos_Comments_Final_021909.pdf)
- Wakefield and McNutt. 2008. An Ecological Framework for Resource Equivalency Analysis (REA). Proceedings of the 2008 International Oil Spill Conference. Savannah, Georgia.
- Tomasi, Wakefield, and Byrd. 2003. Habitat Equivalency Analysis: Implications for Endangered Species. Proceedings of the 2003 International Oil Spill Conference. Vancouver, Canada.
- Penn and Tomasi. 2002. Calculating Resource Restoration for an Oil Discharge in Lake Barre, Louisiana. Environmental Management.
- Robilliard et al. 1997. Ephemeral Data Collection Guidance Manual, With Emphasis on Oil Spill NRDA. Proceedings of the 1997 International Oil Spill Conference. Fort Lauderdale, Florida.