



# The Rain Follows the Forest

A plan to replenish Hawaii's source of water

## FACT SHEET

- *The Rain Follows the Forest* seeks to ensure mauka watersheds are fully functioning so fresh water resources can be utilized and enjoyed by the people of Hawai'i in perpetuity. This plan implements the central goals of the Abercrombie administration's *A New Day in Hawaii* plan to steward the natural resources that our survival, economy, and quality of life depend on.
- *The Rain Follows the Forest* provides policy solutions to manage invasive species, increase Hawaii's ability to withstand impacts from climate change, and restore capabilities of the Department of Land and Natural Resources (DLNR) by finding additional sources of funding.
- Hawaii's water supplies are under threat from hotter and drier conditions from climate change, as well as loss of watershed forests.
- Over half of Hawaii's forests have been lost. Invasive alien (non-native) species trample and devour vegetation, leaving bare ground or openings for alien plants that consume more water and increase runoff. Controlling these and other threats while also re-planting forests requires a large-scale effort.
- Protecting *mauka* forest areas is the most cost effective and efficient way to absorb rainwater and replenish groundwater. The Hawaiian islands' sustainability and continued over-all well being of its residents and future generations depends on the continued health of the upland forests.
- In addition to protecting our water supply, the protection of forests is essential to prevent erosion that muddies beaches, coral reefs, and fisheries, reduce Hawaii's greenhouse gas emissions, and protect the native plants and animals unique to our islands.
- Currently only 10% of the priority watershed areas are protected, a level of management that has taken 40 years to achieve. DLNR's goal is double the level of protection in the next ten years, which will require approximately \$11 million a year. If funded, this initiative will create over 150 local jobs.
- In an October 2011 statewide telephone poll of 700 residents, 78% of respondents were supportive of increased funding for watershed protection from \$1 million to \$11 million per year. A majority supported increased general funding (mean support was 7.4 out of 10), the use of environment-related taxes (7.4 out of 10), or a visitor-related tax (8.0 out of 10). Further, 59% of respondents indicated the urgent need to increase the protection of the sources (upland forests) of our fresh water supply, and rated the urgency to protect these sources at 8.4 out of 10, with 10 representing "Extremely Urgent."

- *The Rain Follows the Forest* identifies priority watersheds and outlines on-the-ground actions and projects required to protect and sustain Hawaii’s critical water sources. To be successful, these actions must occur on a large scale across ownership boundaries, through agreements and leveraged funds provided by the statewide watershed partnerships.

## STATISTICS

- A century-long trend<sup>i</sup> of declining rainfall has accelerated, with a 12% decline in the last 20 years alone.<sup>ii</sup>
- Groundwater head levels in Pearl Harbor, which supplies over 60% of Oahu’s municipal water,<sup>iii,iv</sup> declined by half since 1910.<sup>v</sup>
- Hawaii’s native forests absorb moisture from rainfall and passing clouds that condense on the thick vegetation. Intercepting cloud drip increases water capture by as much as 30% of rainfall, and increases groundwater re-supply by 10-15%.<sup>vi</sup> On Lāna`i, fog water supplies even more water than direct rainfall.<sup>vii</sup> There, loss of the forest’s fog capture would reduce by half the island’s only water supply.<sup>viii</sup>
- Water users already pay for the loss of native forests – and those costs are high. Invasive and widespread strawberry guava evapotranspires 27%-53%<sup>ix</sup> more water than native forests, causing extensive water loss across landscapes. For example, in East Hawai`i invasive plants have already reduced estimated groundwater recharge by 85 million gallons a day.<sup>x</sup>
- Even a small percentage reduction in groundwater recharge can be costly. One study indicates that a 1% loss of recharge in the Ko`olau Mountains could cost O`ahu \$42 million net present value.<sup>xi</sup> Another study indicates that a 10% loss of recharge in the Ko`olau Mountains could cost \$1.7 million per year - over \$173 million net present value.<sup>xii</sup> The gradual invasion of alien plants into native forests may have already reduced the estimated groundwater recharge by up to 10% in certain aquifers.<sup>xiii</sup>
- A University of Hawai`i study examined the various services provided by Oahu’s Ko`olau forests—including water recharge, water quality, climate control, biodiversity, and cultural, aesthetic, recreational, and commercial values. These services were calculated to have a net present value of between \$7.4 and \$14 billion.<sup>xiv</sup>

## KULEANA – CARING FOR THE LAND

- The importance of forests for water has long been recognized – expressed in the ancient Hawaiian proverb “*Habai no ka ua i ka ululā`au*” (the rain follows the forest). Protecting these forests has been codified into Hawaii’s customs and laws. In 1876, King David Kalākaua signed an Act for the Protection and Preservation of Woods and Forests. The Act included the construction of fences and barriers to prevent hooved animal trespass into forests important for water resources. In 1893, Queen Lili`uokalani established the Bureau of Agriculture and Forestry for the “preservation of forests,” among other purposes. Following this, Article XI of the Constitution of the State of Hawaii includes the protection of all natural resources, held in the public trust.

- This plan perpetuates ancient traditions of protecting and respecting the sacred *wao akua* - misty upland forests. The plants and wildlife within them are individually revered in Hawaiian traditions as manifestations of gods, or used for medicines, offerings, or other material needs.
- Actions in this plan enhance these cultural practices by protecting these native natural and cultural resources from damage and extinction. Caring for these resources has been a way of life in Hawaiian traditions.<sup>xv</sup> Access to priority protected areas for traditional Hawaiian cultural practices is not restricted by this plan. In DOFAW areas, step-overs and gates will allow continued public access into fenced areas.
- On Division of Forestry and Wildlife (DOFAW) lands, public hunting will be a priority action in the first stage of ungulate removal in fenced areas wherever safe, feasible, and effective,<sup>xvi</sup> and DOFAW will encourage and facilitate hunting access in other areas.
- Fencing core areas within the priority I and II watersheds will be incremental, and will gradually reduce public ungulate hunting areas over this century. Once all of the priority watersheds are fenced, public ungulate hunting areas will be reduced by approximately 30%. Approximately four percent of DOFAW lands are currently fenced.
- This plan seeks to increase public access to enjoy and learn about the forests that help to sustain Hawaii. This will help to build an informed citizenry of life-long learners who value Hawaii's uniqueness and live sustainably. Maintaining and creating access and trails will teach communities about the benefits of forests during volunteer trips and hikes.
- As part of the local jobs that this initiative seeks to fund, DLNR will support continued and expanded programs that provide local youth jobs and career opportunities during in-the-field internships. This will instill current and future generations with a sense of *kuleana* to respect and give back to the life-giving forests.

**E mālama i ka 'āina, a e mālama ho'i ka 'āina iā 'oe!**

**Care for the land, and the land will care for you!**

- <sup>i</sup> Chu, P.S., H. Chen. 2005. Interannual and Interdecadal Rainfall Variations in the Hawaiian Islands. *Journal of Climate*. 18: 4796-4813.
- <sup>ii</sup> Mean statewide rainfall, as compared to 1920-1989 period. Giambelluca, T., Q. Chen, A. Frazier, J. Price, Y. Chen, K. U. C. Chua, C. Tu, H. Van Nguyen, J. Eischeid, D. Delporte, M. Best, K. Miyagi, P. Chu, K. Kodama, H. Diaz, C. Daly, T. Schroeder, M. Nullet. 2011. Rainfall Atlas of Hawai'i, University of Hawai'i at Mānoa, Department of Geography. <http://rainfall.geography.hawaii.edu/acknowledgments.html>
- <sup>iii</sup> Oki, D. 2011. Groundwater Recharge and Availability in the Pearl Harbor Aquifer, O'ahu, Hawai'i. <http://hi.water.usgs.gov/studies/pearlharboraquifer/>
- <sup>iv</sup> Board of Water Supply, City and County of Honolulu. 2011. Island of O'ahu Development Plan Areas. Estimated Population Distribution & BWS Water Demand (CY 2000). <http://www.hbws.org/cssweb/display.cfm?sid=1406>
- <sup>v</sup> Liu, C. C. K., L. S. Lau, J. F. Mink, 1993. Ground-Water Model for a Thick Fresh-Water Lens. *Groundwater*. Vol. 21, No. 3. May-June 1983. <http://info.ngwa.org/gwol/pdf/831522905.PDF>
- <sup>vi</sup> Department of Land and Natural Resources. 2001. Annual Report to the Twenty-First Legislature 2001 Regular Session on Act 152 SLH 2000 (HB 2835, HD2, SD2, CD1) Relating to Watershed Protection.
- <sup>vii</sup> Maui County Department of Water Supply. 2010. Water Use Development and Protection Plan – Lāna'i. Submitted by the Department of Water Supply in consultation with the Lāna'i Water Advisory Committee. <http://www.co.maui.hi.us/index.aspx?NID=1617>
- <sup>viii</sup> Hardy, R. 1995. A Numerical Groundwater Model for the Island of Lana'i, Hawai'i, State Department of Land and Natural Resources, Commission on Water Resource Management.
- <sup>ix</sup> Giambelluca, T. W., Delay, J. K., Asner, G. P., Martin, R. E., Nullet, M. A., Huang, M., Mudd, R. G., Takahashi, M. 2008. *Stand Structural Controls on Evapotranspiration in Native and Invaded Tropical Montane Cloud Forest in Hawai'i*. American Geophysical Union, Fall Meeting 2008, abstract #B43A-0422.
- <sup>x</sup> Engott, J. A. 2011. A water-budget model and assessment of groundwater recharge for the Island of Hawai'i: U.S. Geological Survey Scientific Investigations Report 2011-5078.
- <sup>xi</sup> Pitafi, B., J. Roumasset. 2004. Watershed Conservation and Efficient Groundwater Pricing. Prepared for the Agricultural and Applied Economics Association Annual meeting, Denver, CO, 2004. University of Hawai'i at Mānoa.
- <sup>xii</sup> Gutrich, J. J., D. Donovan. 2001. Environmental Valuation and Decision-Making: Science as a Tool in the Management of Hawaiian Watersheds. Report to the U.S. Forest Service, Institute of Pacific Islands Forestry, Honolulu, Hawai'i. Assuming a 2% demand growth and a 3% discount rate, adjusted for 2011 dollars.
- <sup>xiii</sup> Engott, J. A. 2011.
- <sup>xiv</sup> Roumasset, J., J.B. Kaiser, N. Krause, D. Mecham and J. Wooley. 1997. Draft Environmental Valuation and the Hawaiian Economy. University of Hawai'i Economic Research Organization, UH- Mānoa.
- <sup>xv</sup> Kumu Pono Associates. 2004. He Mo'olelo 'Āina: A Cultural Study of the Pu'u Maka'ala Natural Area Reserve, District of Hilo and Puna, Island of Hawai'i. Prepared by Kepā Maly and Onaona Maly for the Natural Area Reserves System. Available online at: <http://hawaii.gov/dlnr/dofaw/nars/reserves/big-island/puumakaala>
- <sup>xvi</sup> Department of Land and Natural Resources, Division of Forestry and Wildlife. 2007. Review of Methods and Approach for Control of Non-Native Ungulates in Hawaii. March 1, 2007. Technical Report No. 07-01. <http://www.state.hi.us/dlnr/dofaw/pubs/Ungulate%20Control%20Methods%20FINAL%20Mar%202007.pdf>