Kona
Soil and Water Conservation District
81-948 Waena'Oihana Loop # 101 - Kealakekua, HI 96750 - 808-322-2484 - FAX 808-322-3735

The Kona SWCD is excited that the PIA was selected to be part of this pilot program to determine the best way to control feral pigs with a high likelihood of success that they won't return.

Many organizations are involved in protecting the forests from feral pigs, namely, NRCS, The Nature Conservancy, The Three Mountain Alliance; the National Park Service, There have been studies on the feral pig impact to the forest and management practices to control them, generally fencing and population control.

We want to highlight the concerns we have for our soil resources on cropland. We feel our cropland soils are being overlooked as a valuable resource so this tour will be of feral pig damage to cropland. Feral pigs are a problem throughout the state but much of Hawaii Island is unique. In N. and S. Kona a vast majority of our landscapes have soil with a T Factors of 0 or 1. Our landscapes average less than 5,000 years of age so our soils are very young. They are just in the beginning stages of their development and need protection.

On behalf of all our cropland farmers we ask that NRCS approve the use of fencing on cropland for the purpose of protecting our soils from tilling by feral pigs. Agronomic practices simply act as an attractant making a problem worse or, on the promise of improving soil, creating one where it did not exist. Kona is predominately orchard farming and the crop is not what the feral pigs want, they want the soil. We understand there is always concern about exploitation of practices which is why rules are developed. We will be happy to provide recommendations.

The most common practice for our cropland users is mulching. Their plan could call for hundreds of cubic yards of it. Without a fence it is an open invitation to feral pigs. If there is an irrigation system as well it is like a free buffet and an open bar to the feral pig population. How can we recommend this to our cooperators?

Eradication will not work. Feral pigs we have today were brought here in 1778 and allowed to roam free. At their reproduction rates eradication would have had to have been done a long time ago. Also, hunting and consumption of the catch is part of the local culture. We understand population management is also a requirement for feral pig control and that may be there is not enough hunting to keep the populations in check.

The bottom line is if we do not want feral pigs on a piece of land and a fence is not an option the only other option is to create conditions that do not support them, poor soil and a lack of water which is not something anyone wants. Our options are limited, our cooperators need help protecting their soil.

This report was funded by Hawaii County's Department of Research and Development

Kona Soil and Water Conservation District
Feral Pigs and Kona Soils

The feral swine we have on Hawaii Island are a relatively recent introduction. Captain Cook brought the European Boar to Hawaii Island in 1778 and they were allowed to roam free. They are now hunted as a food source but remain possibly the most destructive forces working against our soil resources. A vast majority of soils within the Kona SWCD have a T Factor of 1. This is an estimate of the maximum average annual rate of soil loss, in tons per acre, which can occur without significantly affecting crop productivity. NRCS uses the soil properties of texture, saturated hydraulic conductivity, available water capacity and depth to restrictive layers, such as pahoehoe lava, to determine a soil's T Factor. A T Factor of 1 indicates very fragile, thin soils.

Our soils are thin because the age of our landscape is very young, 1,000-3,000 years old. Some of it significantly younger, the Kona International Airport is built on a lava field created in 1801. Since it takes up to 1,000 years for Mother Nature to build just one inch of soil you can understand why our soils are so thin. The bulk of the material used to create our soils is organic matter. Because it is organic matter it is vulnerable to erosion not just through water and wind erosion, simply exposing our soils to the atmosphere will cause them to begin the process of breaking down. Because of the rocky nature of our soil whatever does not get lost through erosion or volatilization filters down into the rocks. In the photo below you will see the earliest stages of soil development.

The native `ōhi`a tree is a pioneer species and historically would be one of the first plants to appear in a lava field. Today, invasive species maybe the first to be established in a lava field, particularly fountain grass. Regardless of which species is first, it is organic matter that builds our soil.

This `ōhi`a tree is growing in an `a`a lava field. The leaf litter under the tree is early soil formation. Mother Nature will take a long time and a lot of leaf litter to create a layer of soil. This lava flow is from the 1900s and came from Mauna Loa.

As one tours around Kona they will notice two distinct types of lava, one is called `a`a which is very rocky and difficult to walk on without thick soled shoes. The `a`a lava does not restrict water flow, can be very deep, and as soil develops it falls into the spaces between the lava rocks. The other is called pahoehoe which is flatter and may appear to have a rope-like surface. This form of lava does restrict water movement and is generally considered the impervious layer. You will also notice, where the road has cut through lava, that a layer of pahoehoe can cover a layer of `a`a and vice versa, as well as layers of ash and soil.

In 2007 this area saw a destructive flash flood. There was concentrated flows and sheeting across this area of S. Kona. Above is an area that saw significant erosion during that event.

What you are looking at are trees growing out of a field of rocks. There are some grasses growing and some leaf litter but even the pigs don't bother this place, there is no soil.

This is a coffee orchard with trees growing out of rocks. The brownish substance on the surface is either moss or leaf litter, it is not soil.

This field is not fenced. If the cooperator were to begin improving the health of the soil here visits from feral pigs would be of no surprise.

Most of the landscape in Kona has a T Factor of 0 or 1, (see maps). Our soils are thin, young, organic and generally on a 2-20% slope, some with a significantly greater slope. A farm that is fairly level is uncommon. The feral pigs till our soil. According to NRCS on their "Discover Soils from the Ground Up" web page "tilling soil is the equivalent of an earthquake, hurricane, tornado and forest fire occurring simultaneously in the world of soil organisms." Tilling soil, drinking water (sometimes damaging irrigation systems to do it) sleeping and reproducing is pretty much the life of a feral pig in Kona.

Our farmers treasure their soil and are constantly working toward improving it. Jim Sutter, former Soil Conservationist in the Kealakekua Field Office and DC in Iowa, currently a DC in Florida, was asked about the biggest difference between Kona farmers and Iowa farmers, "Kona farmers love their soil, and they get upset at even a little bit of erosion. They know they cannot afford to lose any of it!" Many are making sure they don't lose it by keeping it covered with conservation cover, cover crops and mulch. Farmers generally do not till their land because of how shallow the soil is and the damage that would be done to both the soil as well as any tilling equipment.

Of all the cropland practices NRCS authorizes for use in cropland within the Kona SWCD mulching is possibly the most popular. It is not uncommon for a farmer to bring in hundreds, even thousands, of cubic yards of mulch to build their soil. Our farmers want to improve their land and improve their soil's health but maintaining healthy soil in Kona does have its share of challenges, slope, intense rain, and rockiness, though the greatest challenge to improving soil health is feral pigs. Feral pigs love healthy soil too but unlike the farmer, the feral pigs will attack and destroy it, then move on.

Soil destruction by feral pigs is a long time problem for the agricultural community in N & S Kona. Our soils are thin, organic, fractured and highly permeable and therefore more susceptible to feral pig damage. Since most of our farm land has a T-Factor of 1 when a feral pig is tilling soil here he could be attacking ALL of the soil to the impervious layer.

Thanksgiving weekend 2007 South Kona experienced a very significant rain event producing flash flooding and erosion that in some places scraped the landscape bare to its impervious layer.

	This is a flash flood brought on by 7 inches of rain in approximately 3 hours. The farm, thankfully, had a fence. Virtually the entire farm has conservation cover. The tall grass through which the water is flowing is vetiver, planted to slow the flow of flood water. Please note the brown color to the water.
	When the muddy river flow finally stopped the farmer was left with this, soil removed to the impervious layer. This photo clearly shows how shallow our soils are. This runs from one end of the property to the other.

The water flowing in the bottom of the photo is the channelized flow that cut through the vetiver grass shown in a previous photo. The water flow in the center of the photo is a sheet flow. In the background you can see the extent of the conservation cover on this farm.

The fence also prevented larger lava rocks from being part of the sheet flow. If there were large rocks in the sheet flow the integrity of the conservation cover would have been negated by the holes the rocks would have created. Those holes to the cover would have allowed the water access to the soil underneath thereby increasing the erosion on this land.

The land in the photo is the same as the previous one but taken from the north side of the sheet flow.

The type of rain events that create this type of flash flood is not uncommon in the Kona SWCD, or anywhere else in the state. Our slopes average 13%, per Kona SWCD Director Rick Robinson. Add to that the nightly tillage of our very thin soils and catastrophe is somewhere on the calendar.

	This is on the same farm as the previous four photos. This is the day after the flash flood. Thankfully these farmers value their soil and keep it covered. The next photo will show what can happen when large rocks are part of the flow.
	Thanksgiving 2007 rain and flash flood event. Again, we see on this farm just how shallow the soils within the Kona SWCD are. This farm is an orchard farm producing a large variety of tree fruit such as citrus, mango, and papaya among others.

	This photo was taken on the same day and from the same spot on the same farm to show the condition of the entire farm prior to this flash flood, conservation cover throughout. The farmer does this to protect his soil. Under the tree in the left center of the image you can see where some debris from the flood has accumulated. If pigs had tilled the soil in this area of the farm it too may have washed away to the impervious layer.
	As these rocks came down with the flow of water. First they crossed the farm slamming into the conservation cover doing the terrible damage shown in the photo above, then they crossed Mamalahoa Hwy and came down through this farm located across the street. As you can see many of the rocks finally came to rest in the driveway.

In 2007 Hawaii County entered into a Feral Pig Control Pilot Project with Animal Plant Health Inspection Service, Wildlife Services. This was a one year contract that in place from 7/1/2007 through 6/30/2008. That Environmental Assessment and final report from Hawaii County is included as part of this report.

In 2009-2010 the state of Hawaii experienced a long term drought. Hawaii Island was particularly hard hit with large areas designated as a D4 drought. The Kona District was predominantly in drought classified as D2 & D3, severe to extreme. During that drought farmers reported an increase in feral pig damage. The pigs had come down from the forest looking for water.

Comments from our cooperators include the following:

“The 30 acre parcel next to me was grubbed and hundreds of pigs came out of it. I’m glad I have a fence.”

“When they developed Hokulia subdivision is when the pigs started coming onto my land.”

“I don’t care about that, I can replant the crop. What am I going to do about my soil?”

“Improving my soil won’t keep the pigs away, it will bring more onto my farm.”

“I make some of my farm available to a friend for a vegetable garden because the pig problem is so bad on her farm she has given up.”

“We couldn’t farm without a fence, we wouldn’t have any soil.”

The next section of this report shows what feral pigs do to our cropland. Only in rare instances are the pigs after crops, generally macadamia nuts. Most of our orchards crops have to be harvested directly from the tree or they may be damaged and not suitable for market. What the feral pigs are after, generally, is soil and the bugs and grubs that are in it. In Kona, the healthier your soil the more likely you are to have feral pig issues with your land, unless you have a fence or all of your neighbors do. It is a challenge to promote soil health when you know your farmers’ soil will be put at risk for destruction.

PHOTO DOCUMENTATION FORM

Client/Business:	**Kona SWCD**	Date Form Completed:		**3/11/2015**	
Photographer:	**Mary Robblee**	Plot ID:		TMK:	**Various**

This report has been generated to demonstrate the level of damage to the soils on the farms within the Kona SWCD. On all of these farms the soil was directly damaged by the feral pigs, the crops were left untouched. As a result of damage to the soil some crop trees can no longer support themselves standing upright and fall over. Loss of a crop tree is because of damage to the soil, not direct damage to the tree. Since these photos were taken some of these farms have had fencing installed to protect their soil.

Description: tilled soil on the left side of the driveway, tilling done by feral pigs. There was a lot of tilling done on this land by feral pigs.

All of the photos on this page and the following page are from the same farm with soil that has a T Factor of 2 on 10-20% slopes.

Description: soil tilled by feral pigs.

Description: irrigation system damaged by feral pigs.

Description: soil tilling within the coffee orchard, tilling done by feral pigs.

	
Description: This is the same farm as shown on the previous page. This farm was particularly hard hit. More feral pig damage caused by tilling soil. There was no damage to crop on this farm, the damage was to soil and the irrigation system.	Description: Fortunately this farmer was able to obtain a fence with financial assistance through EQIP. You can see the coffee trees in the background as well as what looks like a pile of mulch. There is a significant improvement to the soil health on this farm now that there is nothing coming onto the land to destroy it, namely feral pigs. If we want to protect our soils and keep them on our farms this is the solution.
	
Description: More feral pig damage. In this photo they tilled land adjacent to a water course. You can see additional damage toward the upper left corner of the photo	Description: Feral pigs tilling the soil provides this as a result. This is an area where water flows onto this property during significant rain events.

	
Description: The two top photos and lower left photo on this page are from the same farm. This shows feral pig damage to a recently mulched field. The installation was with financial assistance from NRCS. The crop, dragonfruit, was left alone, the pigs went after the mulch. They have also caused some damage to a recently completed irrigation system, also installed with financial assistance from NRCS. The cooperator reports an additional 30-40 hours of work is required to fix this but he is discouraged because the he believes within just a couple of days it will be tilled again.	Description: Feral pigs created their own on-site resting place. This photo the previous photo and the next photo are from a 12.57 acre farm with three soil MUSYMs on it, all with a T Factor of 1 and all with a slope of 2-10%.
	
Description: Feral pigs simply tear up mulch in their quest to find tasty tidbits.	Description: This photo and all the photos on the following page are from the same farm. Feral pigs will till soil within an orchard like this coffee orchard. Trees can become damaged when significant enough damage is done to the soil. The feral pigs have not shown in interest in consuming coffee cherry, just the soil it grows in.

	
Description: These rocks were part of a rock wall that went along one side of the farm. The wall, for all intents and purposes has been flattened.	Description: more feral pigs damage in the form of tilling soils.
	
Description: More soil tilling by feral pigs. The cooperator was trying to establish conservation cover but found it to be losing battle because of the feral pigs. This farmer once stated “I don’t care about the lost crop, I can replant that, what about my soil?”	Description: The discolored area on the rocks is an access point for feral pigs. The photos on this page, and the last photo on the previous page are from a 2 acre parcel. .77 acres of that parcel has a soil with a T Factor of 2 and a slope of 10-20%, and the balance of the land has soil with a T Factor of 1 and a slope of 10-20%.

	
Description: All of the photos on this page are from the same farm Tilling soil in Kona is done by feral pigs, as shown in this photo. The photos on the page are from an 8.16 ac farm with a soil that has a T Factor of 1 and a slope of between 10 & 20%.	Description: This is a trail created by feral pigs.
	
Description: tilling of soil and mulch by feral pigs.	Description: There has been little to no crop damage on this farm. The only damage that has taken place has been to the soil, the tilling of it by feral pigs. There are farms that have lost orchard trees because of the disturbance to the soil underneath them.

	
Description: All of the photos on this page and the upper left photo on the following page are all from the same farm. This was a complete rock wall and the conservation cover went up to the wall…until the feral pigs started to till the land. The parcel shown on this page has two soils. One of the MUSYMs has a T Factor of 2 with slopes of between 20 & 40%, the other soil has a T Factor of 1 with slopes between 20 & 40%	Description: This is another view of what tilled soil looks like when feral pigs are doing the tilling.
	
Description: This is another view of the previous two photos. The damage shown here continues down the slope to the area shown in the next photo.	Description: This is very near the area in the shown in the last three photos and at one time was also, like the area above it, totally covered with conservation cover

	
Description: more soil tilling by feral pigs. This area of tilled soil is very near the areas shown in the previous 4 photos but is its own distinct example of tilling. This photo is from the same parcel as those on the previous page.	Description: This and the two lower photos are from the same farm. A pig trap used by a local cooperator in their attempt to control feral pig populations on their land. They have been unsuccessful. This photo, and the following five photos are from a farm with soil that has a T Factor of 2 and slope of between 20-40%.
	
Description: A feral pig trail that has damaged a rock wall. The NRCS cost shared irrigation system on this farm has also been damaged by feral pigs.	Description: The center of this photo shows another part of the trail shown in the previous photo. These trails are across the driveway from each other so it part of the feral pig transportation system.

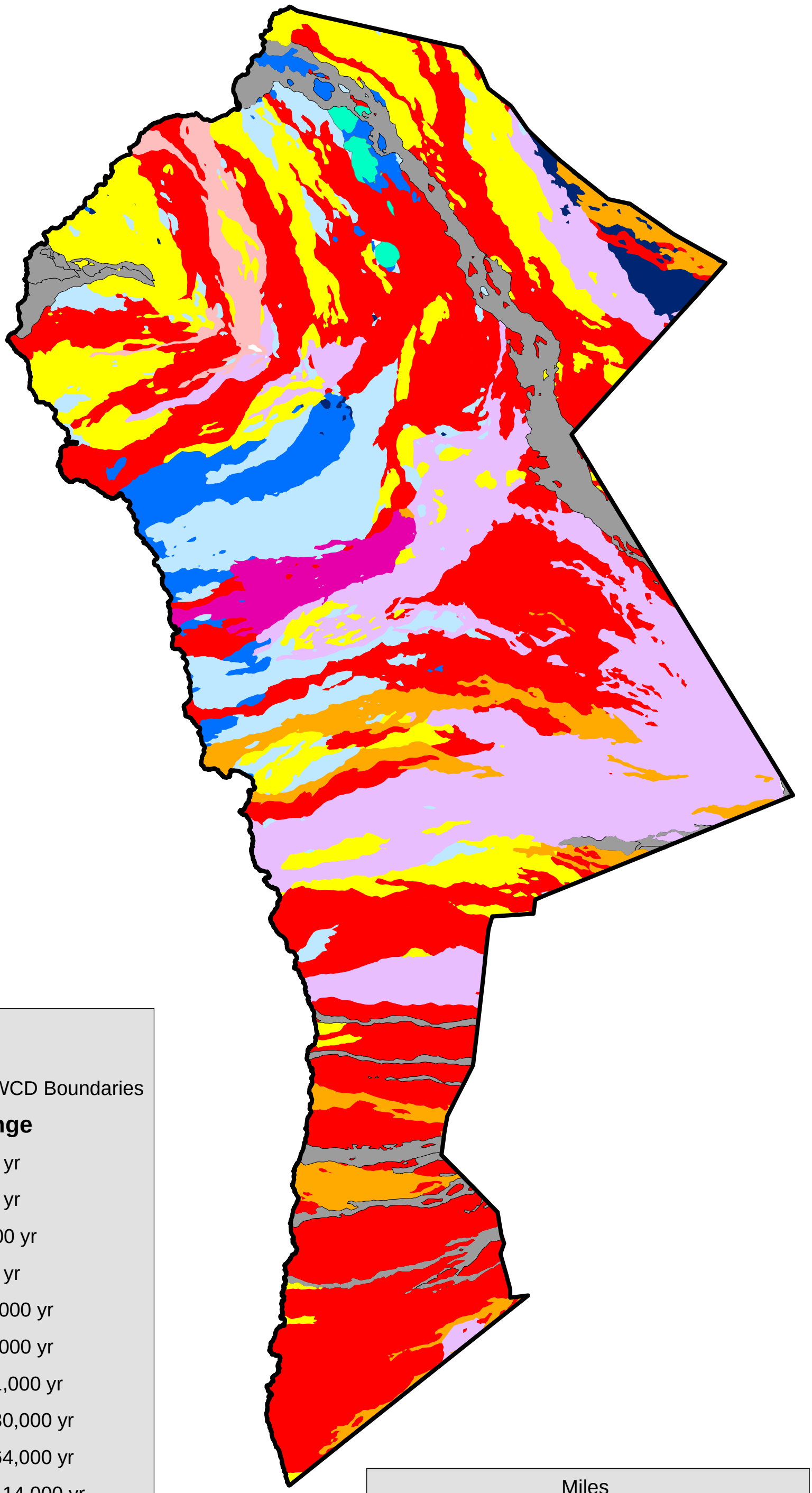
	
Description: The top and lower left photo are from the same farm as the photos as the previous page. The cooperator has pretty much given up putting these rocks back.	Description: Feral pig damage from tilling and damage to the NRCS cost shared irrigation system.
	
Description: Damage to the irrigation system. The cooperator believes this was a juvenile pig that did this. It is believed an adult pigs would have bitten right through and created a tremendous water leak. This cooperator only irrigates during the day and will shut the system down at 4pm.	Description: This photo and the ones on the following page are from the same neighborhood. Tilling of soil along a road by feral pigs. The Army Corp of Engineers, in a draft flood study to update flood maps in S. Kona, describes this road as a watercourse during flood events. This photo, and all those on page 9, are from parcels with soil that has a T Factor of 2 and 10-20% slopes.

	
Description: Ten to twelve years ago this area could be mowed with a sit down mower then the pigs started tilling soil and unearthing rocks. The soil tilling has resulted in a great deal of erosion as can be seen by the palm tree roots.	Description: There used to be a rock wall and grass cover here, until the feral pigs started doing their work.
	
Description: The grass cover in this photo extended all the way back to where the trees are and continued down the slope along the southern edge the property. This area was also maintained with a sit down mower until the erosion and rocks being unearthed and moved about made it too dangerous.	Description: The tilled soil in the photo is directly across the street from the previous photo, therefore along a proposed Army Corp of Engineers proposed watercourse in the event of flooding.

	
Description: All of the photos on this page are from the same farm. What land looks like when feral pigs till soil. It is now ready for erosion. This parcel is fenced but some pigs did gain access due to carelessness of the farmer. Now that the farmer has seen just what kind of damage can be done by the feral pigs there is no more carelessness. All of the photos on this page are from a 1.7 acre parcel with soil that has a T Factor of 2 and 10-20% slopes.	Description: This was a very nice rock wall, one that has been here for years, as can be seen at the top center of the photo, until the feral pigs decided there was something under it they wanted.
	
Description: Soil tilled, rocks unearthed, land is now ready for erosion and invasive species establishment.	Description: More soil tilling done by feral pigs.

The cooperator farming this land is under contract with NRCS to improve soil organic matter by applying mulch. Every time mulch is delivered feral pigs destroy the pile and have made it impossible for her to complete the contract item. She is about to cancel the contract because she cannot afford to fence her cropland. As a result her soil health will continue to degrade.

Kona SWCD Soil Age Range



N
W E
S

Legend

Kona SWCD Boundaries

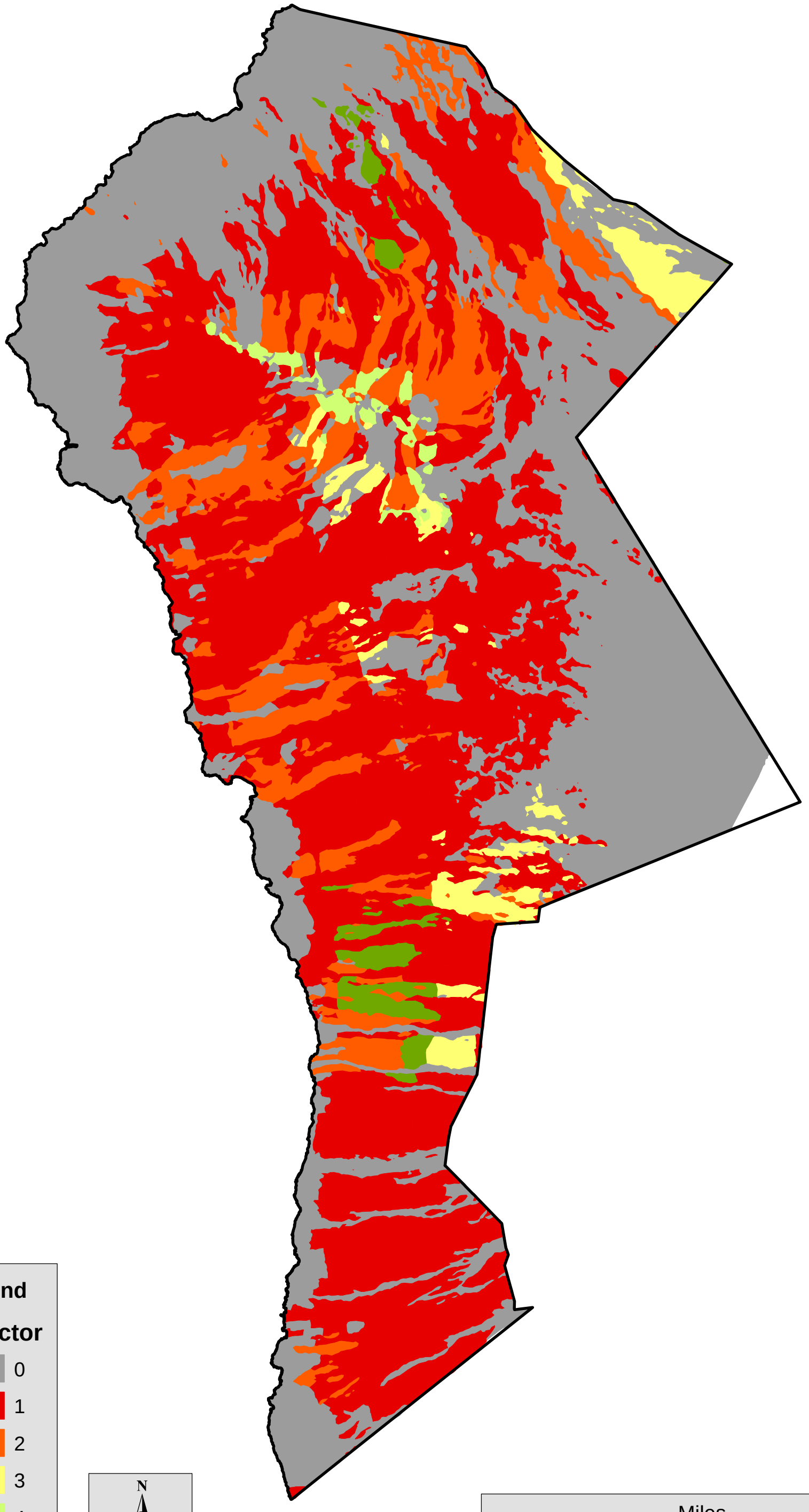
Soil Age Range

- 200-300 yr
- 200-750 yr
- 750-1,500 yr
- 560-860 yr
- 1,500-3,000 yr
- 3,000-5,000 yr
- 5,000-11,000 yr
- 11,000-30,000 yr
- 11,000-64,000 yr
- 92,000-114,000 yr
- A.D. 1800 - present

Miles

4 2 0 4 8 12

Kona SWCD Soils T Factor Map



Legend

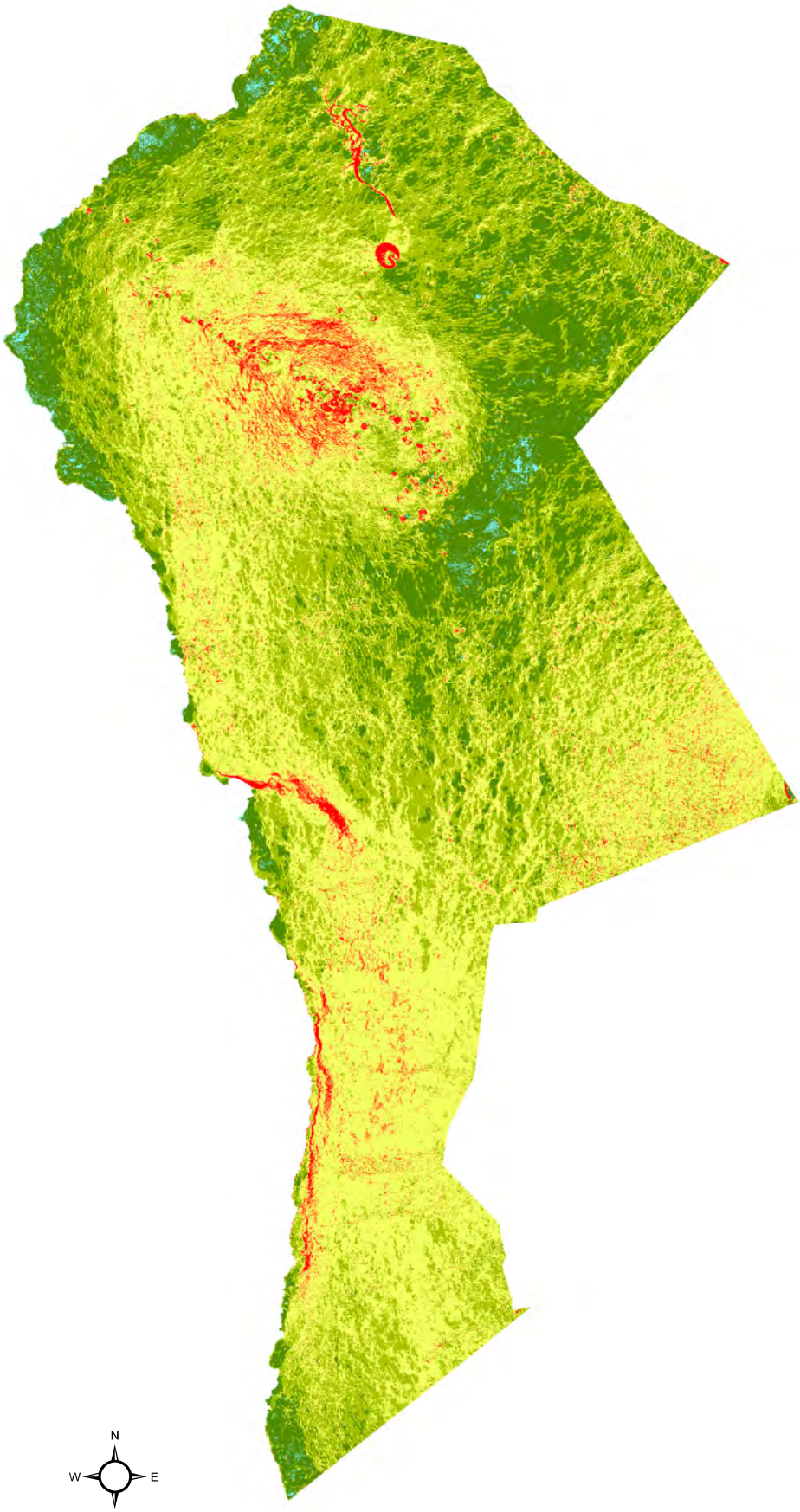
T-Factor

- 0
- 1
- 2
- 3
- 4
- 5

N
W E
S

Miles

4 2 0 4 8 12



Legend

Slope

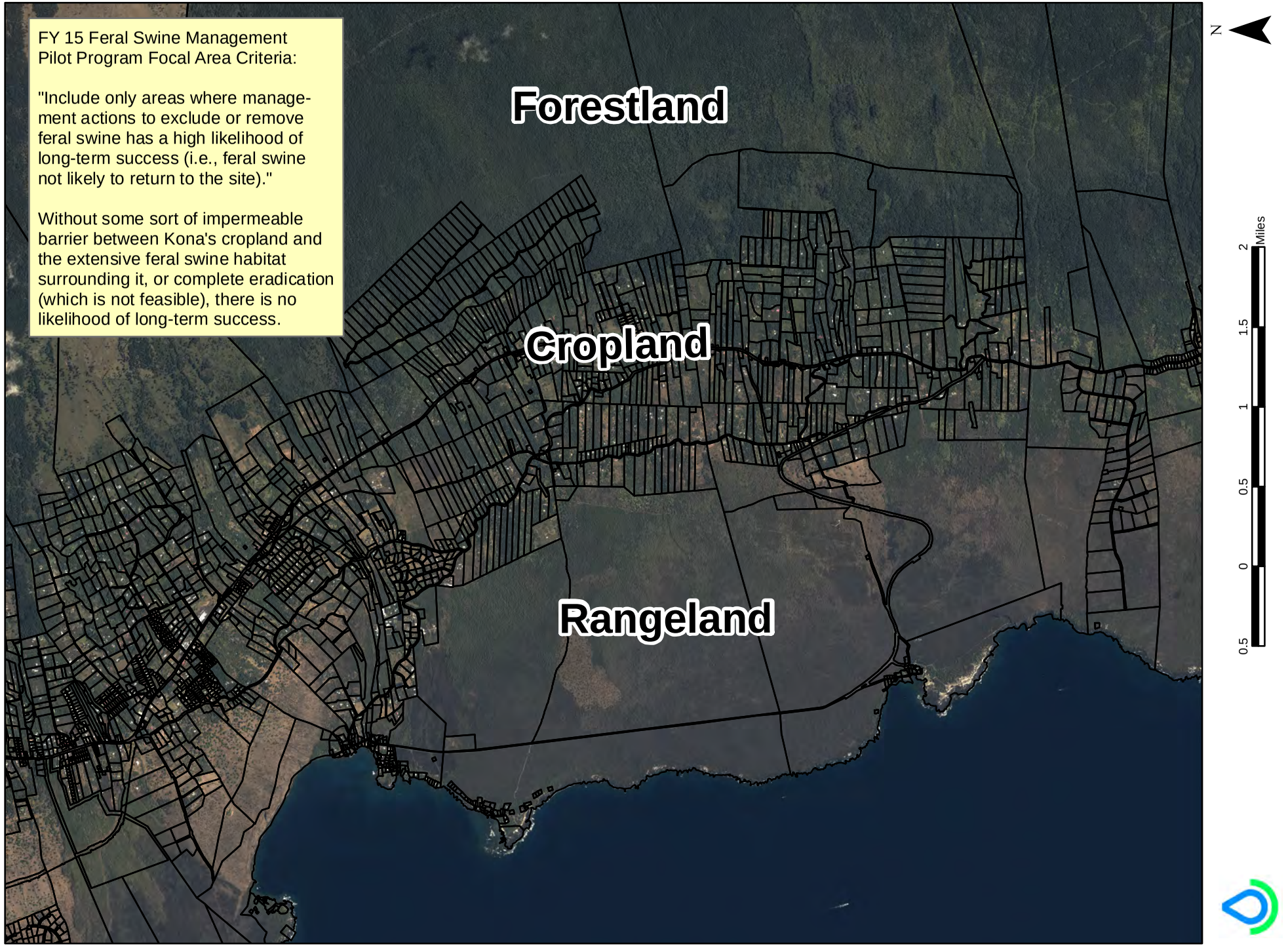
<VALUE>

- 0 - 2
- 2 - 10
- 10 - 20
- 20 - 40
- 40 - 50
- > 50

N
W E
S

1:404,892

0 2 4 8 12 16 Miles


FY 15 Feral Swine Management Pilot Program Focal Area Criteria:
"Include only areas where management actions to exclude or remove feral swine has a high likelihood of long-term success (i.e., feral swine not likely to return to the site)."
Without some sort of impermeable barrier between Kona's cropland and the extensive feral swine habitat surrounding it, or complete eradication (which is not feasible), there is no likelihood of long-term success.
Forestland
Cropland
Rangeland
N
Miles
0.5
0
0.5
1
1.5
2