Asset Investment Management

AIM: On Target Investments

Laguna Salada Development Plan

Volume 12
Tree Farming Operations

Adj. Professor Ronald A. Newcomb
San Diego State University College of Sciences
International Consortium of Advanced Technologies and Security
Director of Operations, Principal Investigator

Contents

Introduction

Paulownia species are rapidly becoming the species of choice for raising lumber, and for good reason. This incredible tree grows 6-12 feet per year and is ready for harvest in as little as five years with a yield of about 30,000 per acre per year.

The introduction of managed forestry in Laguna Salada creates an incredible environment both for the people living in the immediate area, but also for the people in the surrounding area.

More on the tree later, however, with geothermal desalination so inexpensive in this area, Paulownia can be raised using this water efficiently with a large profit margin.

The benefits of raising Paulownia are outstanding on all fronts and the effort to raise this beautiful tree are now worldwide and growing.

For centuries, the Chinese have grown Paulownia, also known as Empress and Sapphire trees for beauty and for highly-prized timber. Paulownia is a fast-growing shade tree that produces a lightweight timber that is used in the making of moldings, cabinets, veneers, furniture and even musical instruments.

In this plan, the entire tree will be used.

Legal Entities

The structural chart is found below and represents the general design of entities in the broader Laguna Salada project area and is not meant to be final, and is not quite complete as the investors are not listed in this diagram.

However, this is a tax efficient and legally efficient structure to operate from. AIM will form a master limited partnership agreement or other entity acceptable to the investor or investment group for these operations. This will include a long term lease on the land with the legal entity controlling the land at that time. (The current situation is, World Wide Assets is negotiating with various Ejidos in the area and ownership or control may change between now and the execution of this plan.)

The investors will participate at an agreed upon ROI and agreed upon tax benefit and carbon credit structure. Carbon credits are calculated from the carbon sequestration potential of any project and Paulownia are especially favorable for this treatment. These would be the first moneys out of this plan.

The founding investors can participate in the master partnership agreement and secondary investors in specific LLC farming operations as they ramp up.

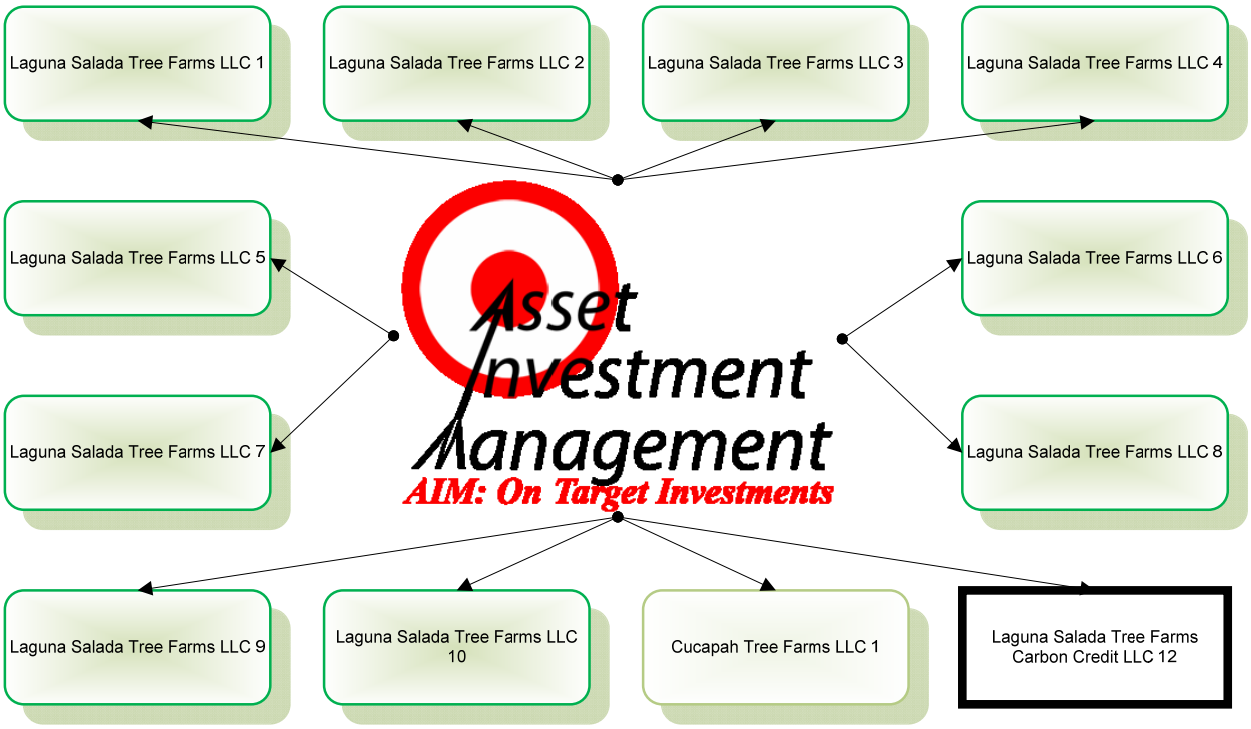


Figure 1, Asset Management Diagram

Paulownia

Kingdom: Plantae

Superdivision: Spermatophyta (seeded)

Division: Magloniophyta (flowering)

Class: Magnoliopsida (dicotyledons)

Subclass: Asteridae (asters)

Order: Lamiales or Scrophulariaceae (figworts)

Family: Paulowiaceae or Scrophulariaceae (different taxonomies)

Genus: Paulownia

Species include: australis; catalpifolia; coreana; duclouxii, elongata; fargesii; fortune; galbrata; grandifolia, imperialis; kawakamii; lilacina, longifolia, meridionalis, Mikado, recurva, rehderiana, shensiensis, silvestrii, taiwaniana; thyrsoidea, tomentosa, viscosa.

Species and Hybrids

The consideration of species needs some research. As with all plant, the environment in which they grow affects the species collection.

Several websites claim to have the fastest growing cultivars or species. Each can be true if you consider each claim to be for a specific location.

The USDA website contains the following abstract from A Paulownia seed source trial in East Texas and its implications to species introduction. Dong, H. Van Buijtenen, J.P. Southern journal of applied forestry. South. j. appl. for. May 1994. v. 18 (2)

"A seed source trial of royal paulownia (Paulownia tomentosa) and white-flowered paulownia (P. fortunei) was established in East Texas in 1987. Results showed that the two seed sources of white-flowered paulownia performed better in survival and in height and dbh growth than both seed sources of royal paulownia over the 6-yr period. No significant difference was found between the two seed sources within each species at the 5% level. The largest tree of white-flowered paulownia was 45 ft tall and 13.8 in. in diameter. The results suggest that white-flowered paulownia is a preferred species in climates similar to East texas." (sic)

Hybrids of these also exist as well as varietals and cultivars selected for their particular characteristics. This location is a high light but low nutrient resource.

In any agricultural setting it is the production that determines profitability. Choosing the correct hybrid can make enormous differences in the return on investment, by a magnitude of difference or more.

While the numbers we present are conservative, at 30 acre feet per board, reports of 300 to 500 board feet per tree after five years would justify a much larger ROI.

Soil

The soils are alluvial aridisols in nature, coming from the rocks forming the mountains which are mechanically and chemically breaking down (the hot/cold cycles helps both) into finer materials and then washing down to form sedimentary layers from the mountains immediately adjacent to the growing area.

Gullies are cut into the alluvial fan, interfan, and piedmont deposits (piedmont here to mean the foothills of the mountain range, the lower part of the fan) circumvent the mountains and reveal evidence of periodic sedimentation and soil formation.

The gullies show a succession sedimentary events resulting in typical alluvium of desert regions from mafic rocks common in these mountains. Sedimentation inevitably results in stratification of soils by particulate size, each of which creates a distinct soil, indicating that each (dry) period of sediment deposition was followed by a period of stability and soil formation. The image to the left is of the alluvial fan on the east side of these mountains and this deposition of materials,

course on the bottom of each deposit to the fine grains at the top. The finest alluvium is carries by the water to the lowest parts of the fan and the alluvial flat, the valley itself so the higher one travels up the fan toward the mountains, the more drainage one can expect. The finest sediments, the mud, will be found in the lagoon areas itself or al least close to the lagoon area id the specific sedimentary event was week, but then these layers would be very thin due to the lack of volume.

Paulownia has a significant problem in soils which form caliche if that caliche layer is thick enough either to prevent drainage or to prevent the tap root from penetrating the layer, a sedimentary layer of calcium carbonate which cements together with water. There are very large deposits of calcium sulfate (gypsum) 20 miles north of this area, however, no large deposits of calcium carbonates, or limestone deposits to create caliche.

Lastly is the lack of organic matter, carbon compounds in the soil.

Carbon compounds, organic matter, humic substances nitrify the soil and help with the production of nutrients and their transportation and uptake in agricultural settings.

Raising Paulownia

Raising Paulownia becomes a problem of understanding the initial seeding process, or in purchasing quality tree starts. Seeding is the most difficult aspect but only needs to be done once. (See Regeneration below.)

Paulownia need sufficient water and nutrient to provide heavy growth until their roots mature after several months and the first 6 feet or so of development. The tree can be harvested in five years at 45-50 feet in height yielding a gross profit of about $30,000 per acre per year.

Soils

Paulownia grow in a variety of soil types which is somewhat unusually broad and can take most soil types as long as they are fast draining and sufficient water is present in their first year. Soil pH can range from 5.5 moderately acidic, to 8.5, moderately alkaline but prefer very slightly acidic at 6.5. This can be maintained once the farm is growing by tilling, and mulching the trees own leaves which yield high amounts of humic substances (Aiken, et al)

Humic substances, humic acid, fulvic acid and thousands of others, result from the degradation of lignin in leaves and other plant substances through aerobic and anaerobic fungal fermentation. These enormously complex molecules maintain soil acidity, help absorb nutrient, especially minerals, and help sequester harmful minerals.

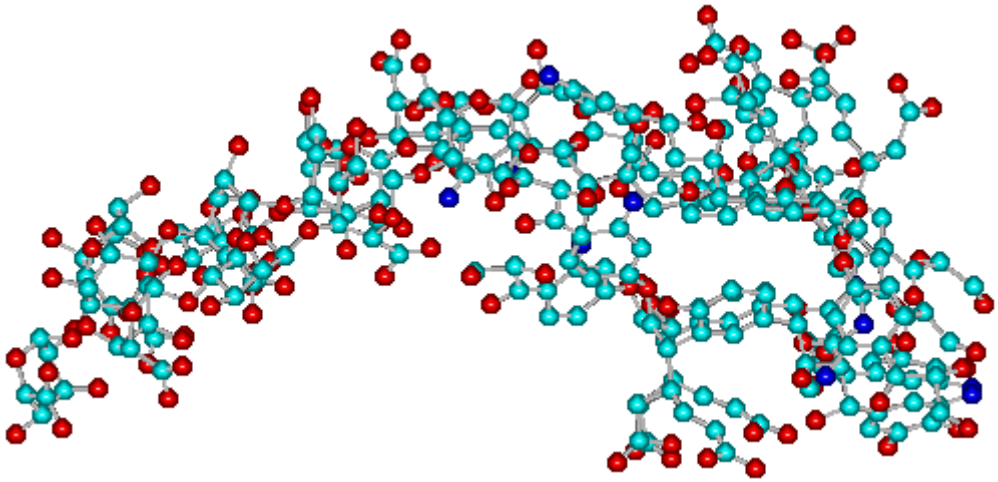


Figure 2, Stick and Ball Model, Humic Acid

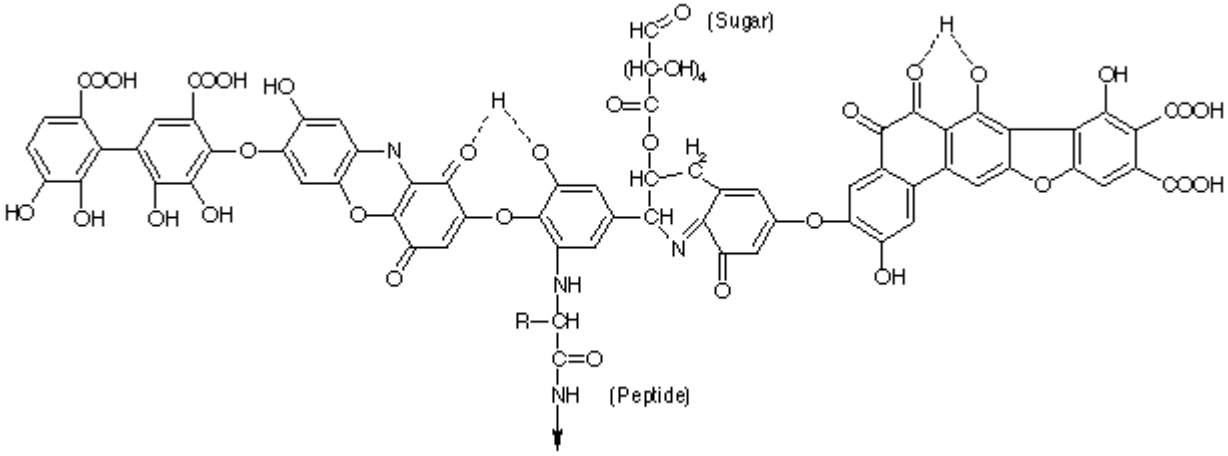


Figure 3, Skeletal Model, Humic Acid

Humic substances (2 images above) are ubiquitous in the environment. Humic acid is a biostimulant and can be used on turf, trees, shrubs, bushes, beds, gardens and even on indoor plants. Almost anything that grows will benefit from humic acid. Their importance in agriculture and soil sciences has been acknowledged for over 150 years. Aquatic scientists have been slow in appreciating their importance, but now realize that they may constitute as much as 95% of the total dissolved organic matter in aquatic systems and often are equal to or greater than the concentrations of inorganic ions present. In many cases they act as the major buffering system, which has serious implications for acidification of lakes and rivers.

While important for microbial processes that drive many ecosystems in our world, the true interest to the chemist is their interactions with other elements and compounds. Humic substances have been documented to interact in some manner with over 50 elements from the periodic table and have distinctively positive results for plants in that they sequester harmful elements as well as increase absorption through several mechanisms of beneficial minerals.

Humic acid increases nutrient uptake, drought tolerance and seed germination. It increases the microbial activity in the soil making it an excellent root stimulator. Humic acid increases the availability of nutrients that are already in your soil and will naturally aerate the soil from the inside. It also will help to lower the pH of the soil and will flush high levels of salts out of the root zone, which brings us to the second limiting factor, salinity.

The second inhibiting factor is salinity. Soils in the lower regions of Laguna Salada can be used only if they have been leached of salts and fertilized with organic fertilizers before planting. While humates are useful in balancing the pH, they are largely unavailable for the first year until the trees lose their leaves the first time. So starting with soils which do not have a salt problem is useful.

Mulching

Mulching allows humic substances to form, helps maintain soil moisture, and improves soils carbon volumes as well as allows for increased soil biology as worms, insects, and fungi begin to build the soil quality from the surface down. These leaves are high in nitrogen, and so, very valuable additions to the soil ecology. But this also makes them useful as fish and cattle fodder.

The alluvial plane we will begin with has good mineralization but poor soil structure. Good drainage, which is beneficial to the growth of Paulownia but poor soil structure.

Nutrients

Nutrients are important for Paulownia for rapid and sustained growth. The plans call for Paulownia to be planted near housing and those housing units to use septic tanks for sewage disposal which provides needed nutrients. Also, people in those forested areas will raise animals, chickens, cows, sheep and goats, all of which can help the forested areas in various ways. Not the least of which is by providing nutrients, but this benefits in both directions as leaves make excellent fodder.

Chickens reduce insects in the area, browsing animals reduce leaves fallen to the ground into nutrient the plants can use speeding up the nutrient cycling in the forests.

People will be encouraged to grow cover crops in the legume family, beans and peas, which fix nitrogen and require less water than other crops, and also which can be used to feed the animals. The 20’x20’ matrix needed for optimal growth allows for cover crops to thrive and actually benefit the lumber crop. Different density can be used for different lumber qualities which may prevent adequate intercropping, but wild flowers and grasses will still take opportunistic advantage of these areas.

Water

Desalinated water is idea for such a forested area when there is adequate mineralization or when salts are present, both of which is the case here. The alluvial plane will annually deliver more minerals from the mountains above the alluvial plane or alluvial fan, but water from the lagoon can be desalinated to create the water needed to grow these forests. Also, since these areas were already slated to have homes, and these homes will use septic, much of that water needed simply goes to grow products for market.

Insect Control

Chicken or Pea Fowl raised with Paulownia can help to fertilize the trees and reduce insect damage, but when insect damage does affect the trees, a simple organic soap insecticide will usually control the trees and can be sprayed en masse since it is non-toxic and benefits the soil.

Other biological control can be implemented as well, as needed.

Regeneration

Paulownia is extremely fast growing; some species of plantation Paulownia can be harvested for saw timber in as little as five years. Once the trees are harvested, they regenerate from their existing root systems, earning them the name of the "Phoenix tree" because they rise up from the felled tree remnants. Paulownia has the ability to reclaim ecologically stressed and degenerate patches of land relatively quickly. Its root systems run deep and penetrate compacted and contaminated soils which have resulted from industrialized development. Paulownia is a phytoremediator, increasing the organic content of degraded soils, processing and filtering contaminants through the uptake of its vascular system, and emitting oxygen into the atmosphere.

By alternating rows of cutting trees, different diameters of trees can result creating different grades of wood and different board widths as well. This technique also allows for better visual effects since you would never see a “clear cut” forest area and the sun allowed through by this technique benefits cover or compatible crops. This is called intercropping.

When this technique is used in a 6-8 row annual cycle, that is cutting one of these rows every year, a more even cash flow is obtained, the visual effect is good, and there is a diversity of product.

Carbon Sequestration

Because of the rapid growth of these trees, carbon is rapidly sequestered from the air, something that millions of people believe will help stop climate change.

Phytodensity Issue

A word of caution needs to be inserted: When you have a large plot of uniform plants you will tend to concentrate diseases and insects which prey on that species.

This can be seen in the manner in which beetles travel though a forest. In years of vacations in Yosemite when I was young, a “V” shaped pattern of dead lumber was formed by bark beetles in the northern slope of the valley when you enter the valley from the south side.

This “V” shape is caused by the predominant wind pushing emergent beetles from tree to tree following the wind pattern. Misunderstood by environmentalists who forced a stop to planned forest burning, fires stop beetles, kill infested trees and prevent them from traveling at ground level (most travel within 18 inches of the soil) by preventing resting locations. However, another disruption to that pattern is a mixed forest where trees that are unaffected by the particular pest can be seen to stop the spread in a similar pattern to the same “V” as a subset of the first pattern.

In other words, the first “V” is disrupted by another “V” downwind if there are several trees of a different variety in the way.

So, biologically speaking, expanding the concept really ought to be done with at least three species of trees even if they are only used for the purpose of fending off insects which dislike their odors, which is the case with many evergreens. Because of this, it is recommended that every few acres, a plot or at least a strip of Thuja be planted.

Before this idea is set aside for the profit potential of Paulownia only farms, first realize there is more than sufficient land for this, and then let me tell a story.

I was supporting a children’s camp east of San Diego several decades ago when the director told me of a pet project. He wanted to plant trees. Only Eucalyptus trees because there were no insects in the United States that attack them. This had been true for a century.

I explained, as above, that the higher the phytodensity the more likely an insect would attack the trees, however, the director wanted to plant Eucalyptus trees which, at the time, has no invasive insect in the United States.

I explained he needed to operate by principal, not by current fact since current facts change.

While I continued to support his project, he continued to use my checks to populate the area with Eucalyptus, so I began to specify different plant varieties on my checks, which he reluctantly complied with. About 6 years later, an insect invasion attacked Eucalypts in San Diego County and most of his Eucalyptus trees were killed by it.

This is a real problem and foresting of trees requires this consideration. We need to operate deductively and inductively at all levels if we are to succeed with maximum impact.

Phytodensity has other implications also. While it is a method of creating long, straight polls, it also lowers the growth and diminishes the plants ability to respond to threats, as well as increased nutrient demand of the forest.

Thuja

This plant is a fast growing evergreen coniferous tree in the Cyprus family but not true Cedars, that will contain volatile oils repulsive to many insects and can grow between 3-5 feet per year.

Thuja var. “Green Giant” is a cross between T. standishii and T. plicata created in Denmark, however, T. occidentalis ‘Giganteoides’ can also be used.

These trees can be planted in long rows, hopefully windward to the Paulownia, and simply used as insect guards, however, harvesting them creates an environment which is, at least, periodically saturated with odors repugnant to insects and leaves in the soil shavings which slowly release their oils over several months.

This is a tree that is highly compatible with the Paulownia at several levels.

Olives

The original plan calls for large Olive groves. These can also be interspaced as barriers to insects because they also contain volatile oils which repel many insects and also yield a valuable crop and do not need to be replaced since this is a fruit crop and not a lumber crop.

Years ago I realized that while grapes are overplanted on a worldwide basis, Olives are under planted. Then New York City banned trans fatty acids, and likely New York State will later join that ban. California has now taken that cause and is likely to ban them for use in prepared foods.

Trans fatty acids are a major health threat to the country.

This will result in a dramatic increase in the use of olive oil since the other major oil source that can prevent trans fats from forming (they are formed under heat in the presence of nickel (stainless steel) by polyunsaturated fats) is coconut oil and they have yet to figure out that a hydrogenated plant oil is perfectly fine for cooking. Also, olive oil is finally coming into its own in the cooking world and is in fact the best oil to use on foods which the exception of butter, which they also have not yet figured out, is actually good for you.

Like the Paulownia, olives need only be planted once and can produce for hundreds of years.

Moringa

Moringa is another possibility, however, usually food crops have mild taste and attract insects so more needs to be researched on this tree before it could be planted en masse, however, this can be a valuable addition to the local diet even in smaller quantities.

Citrus

Citrus yields a valuable crop and the integration of citrus varieties to the plan can be done even if only for insect control reasons and yielding another immediately consumable crop.

California has lost citrus orchards to development over the years and the world demand continues to grow for all varieties.

Teak

Teak is another tree of worldwide interest for the quality of wood and its characteristics. Several Teak clones can be harvested at great profit in 14 years.

Teak sites claim an annualized ROI of 23%. While this is reduced from that from a pure Paulownia farm projection, if a disease or insect invasion manages to attach a pure stand of one variety, the losses can be devastating. A superior approach is the integration of other cash crops which not only levels out the cash flows, even if reduced, but which prevents unforeseen damage by insects or disease.

Intercropping

When discussing insects, the number one intercropping crop is garlic. However, nearly all herbs are beneficial in this regard and some that have a good and strong odor are rosemary, mints, though they require more water, oregano which in Mexico this is marjoram a different specie of the same family, and many other herbs.

But intercropping with bean family (legumes) adds significant nitrogen. Seeding the land in the first year with wild sweet peas and lupine adds a dimension to the land that has visual and biological value.

Wild legumes can be freely distributed in arid regions and can actively contribute to soil fertility in these environments. The nitrogen fixing activity and drought tolerance to drastic conditions may be higher in wild legumes than in crop legumes. The wild legumes in arid zones harbor diverse and, dare we say, promiscuous rhizobia (root loving bacteria) in their root-nodules.

Specificity (limiting the number of plants they attach to) exists only in few rhizobia from wild legumes, however, the majority of them are with wide host range and intercropping of some nitrogen fixing legumes improves biomass yield and herb quality and will fix nitrogen in the forest areas for the Paulownia and also for other trees we suggest below.

Intercropping with any specie of bean or pea is useful and this is a good reason to interject housing into all forested areas.

Tobacco can be useful here in that the plant itself repels insects and simply juicing the plant produces a natural insecticide, nicotine sulfate, which dissipates in a few days but is very effective and actually beneficial to the plants onto which it is sprayed as it speeds up the metabolic processes of those plants. As long as tomatoes or potatoes are not being raised in the immediate area, this is an effective plant and can be raised in all but the densest forest areas. There is a common virus that is spread from tobacco to tomatoes and potatoes.

Pyrethrum is a botanical insecticide extracted from the flowers of a species of chrysanthemum imported mainly from Kenya and Ecuador but which can be intercropped. The material causes rapid paralysis of most insects, but the insects usually recover unless the pyrethrum is combined with a synergist or other poison. The presence of the plant itself, while it makes a nice addition to the forest, helps keep insects at bay.

In general, the growth of any plant with a moderate or strong scent is beneficial to insect control in these forested zones regardless of the species grown.

Tilling

Tilling carries organic matter into the soils both from leaf drop, animal droppings, and fungi and bacteria to help build the soil quality which, in turn benefits the lumber raising process. However, it needs to be practiced judiciously to prevent eliminating wild flowers which are beneficial.

For instance, if tilling is practiced linearly, let's say, horizontally to the tree pattern only, and then the areas between the trees parallel to those tilling areas will continue to grow and produce seeds to continue the biological diversity so important to the health of the forest itself both for soil building and also for continued growth.

Bidirectional tillage would be done just prior to harvesting the trees in the area to be harvested.

Paulownia Market

Paulownia wood is in high demand worldwide and this demand will increase with time since it is soft enough to be easily worked, fire resistant (Li and Oda 2007), attractive, and easy to grow.

Bark can be made into a die. Honey is produced by the heavily flowering tree. Wood pulp can be used to improve soils and also for particle board. The wood is becoming highly popular for guitar makers.

The lagoon area itself can be a major consumer of woods produced in the local farms. Starting compatible industries which consume the products and byproducts gives an immediate market, reduced marketing expense, and significantly reduces the cost of transportation.

Lumber

Paulownia farming is an environmentally sound method of wood harvesting and land enrichment.

Paulownia is about 66% the weight of the lightest commercial wood grown in the United States, with, of course, the exceptional Paulownia harvested there. The average cubic foot weight of Paulownia varies between 15 to 19 pounds which is between Balsa wood and Poplar, also a good guitar wood, about 33% the weight of Oak and half the weight of Pine.

Balsa has been considered to have the highest strength to weight ratios of any wood in the world, however, Paulownia has already been tested as having a higher strength to weight ratio by Auburn University who tested the strength of 18 lb p/cubic ft. against Balsa, with an average weight of 10 lbs p/cubic foot.

Paulownia holds nails and screws well, much better than Balsa, and it does not require pilot holes. In fact both yellow poplar and white pine have proven to split before Paulownia. Flat head

screws can be driven flush with the surface without cracking, making wood working much easier.

Air-drying takes as little as 30 days, especially in this dry desert climate at Laguna Salada.

Thermal conductivity is low making Paulownia a good insulator. Paulownia log homes are said to have twice the R factor as pine or oak logs. This temperature resistance serves to give the wood a high fire resistance. Ignition temperature is approximately 400 deg. C. which is almost twice many conventional American hard and soft woods.

Paulownia remains stable during changes in humidity and experiences little shrinkage or expansion compared to most other woods. It is highly durable and resists decay under non-ground contact conditions. The wood is insect resistant. In the dry desert areas, lumber would experience almost no decay problems unless it is in contact with garden soil.

Operation of wood mills at Laguna Salada would also create wood chips useful for fire logs, soil improvement, and smoking of fishes as well as wood for barbeque. The pulp is useful to the paper industry (Caparros 2008).

When expansion of forested areas is desired, tilling in this material helps prepare the soil by adding needed carbon for soil preparation, and so helps us to expand the plantations when needed or desired.

Currently, Paulownia commands a premium price per board foot comparable or exceeding cherry wood and Poplar. By cooperating with local cabinet makers and other wood working operations as well as local milling, Paulownia provides a complete system of income generation for the area.

There are approximately 6,000,000 acres of Paulownia cultivated worldwide and demand is growing. The current pace of new plantations cannot keep up with demand. This trend will likely continue for the next few decades before leveling off.

Musical Instruments

Paulownia is used in musical instrument production. Taylor Guitar is a company local to the author, just 100 miles from the lagoon which may be contacted to move into the lagoon area to use this wood in production of stringed instruments, perhaps expanding this into woodwind instruments as well. Percussion boxes are growing in popularity. These too can be made.

Paulownia Log Structures

Paulownia can be made into log homes, office, and resorts of various types because of the above referenced low thermal conductivity, ease of growth, and handling.

Entire tracts of homes could be built using wood produced right on site and with very little processing.

Round log, flattened rounds, ¼ rounds (round on the outside only to leave a flat interior and construction surface interaction) and square log homes are easily constructed using this wood.

Its light ash like color is attractive and easily stained to look like other woods. For exterior or interior wood working, this is a good benefit.

Smoking Fish

The fish selected to be bred at Laguna Salada, all native fishes, are mild in flavor and heavily flavored wood smoke would be inappropriate for this purpose. Paulownia wood makes a good base wood for smoking even if other woods are added to this.

The Lagoon can be known for its Paulownia smoked fish, and Paulownia barbeques when the wood is used in this fashion it generates a higher heat. However, because of its ability to resist fire, planks made from Paulownia would yield a nice flavor to croaker barbeques on it after soaking in water, which can then be used as a serving board (with an under guard of a plate or paper place holder).

Fish barbeques over a water soaked board imparts a wonderful mild flavor which is very appealing and this does not prevent herbs, fruits, or other stronger flavors from being used as well.

Ash, or pot ash, is largely comprised of carbon and potassium from whence the word is derived.

Tea

Various types of tea can be produced only from Paulownia, a leaf tea, a flower tea, fruit tea (outer tissue of the fruits), and various mixed teas or leaves, fruits, and flowers. Of course, this also means both black and green teas can be mixed with the flowers and fruits to produce a mild scented tea. All of these can be marketed worldwide.

The Paulownia flower has had 69 essential oils isolated (Liao, et al) all of which add a nice flavor to teas, black or green, or Paulownia tea. A manner this can be implemented with flair at local restaurants is to create a sun tea placing washed fruits, leaves, and flowers or any combination thereof in water and allowing them to soak in sunlight which creates a refreshing tea in a few hours. Dried leaves can be crushed into a more storable form to create sun teas all year long while fruits and flowers need to be used fresh. If sweetened with Paulownia honey a brand of tea is developed as well as specific flavor identification for marketing positions of the resorts. This would be especially true if the resort were constructed of Paulownia logs and/or resided in a Paulownia forest itself.

Paulownia fruit skins are known to contain an excellent mix of flavones or bioflavonoid compounds (Asia, et al).Not less than fifteen flavones have been isolated from the fruits. These show free radical savaging behavior beneficial in heart and arterial conditions and prevention as well as general ant oxidative assistance, therefore, anticancer activity.

Honey

Honey can be prolifically harvested from the trees in early to mid springtime after the 6 week blooming period (after the second year of growth). Single flavored honey, or varietals of honey are favorites of honey connoisseurs and Paulownia honey can become a staple sweetener at the lagoon. This honey can be used to cure fish before smoking creating a sweet smoked fish.

Salads?

Paulownia flowers are fully edible and make a nice addition to salads, again, a potential signature product for Laguna Salada in the springtime.

Chickens

Chickens can be raised under the Paulownia, and while few insects bother Paulownia, this does help with insect control while providing food for the local people as well as an additional cash crop.

Cattle

As stated above, cattle can use the annual leaf fall as fodder. Cattle benefit from being raised under the trees feeding on green grasses year long until this annual leaf fall in winter, when this fodder is recycled by the cattle into nutrient for the tree farming operation. These leaves are high in nitrogen and therefore help with protein in the animal diet, which, again, benefits the trees since the animal waste is higher nitrogen as well.

Each tree past the first year can be expected to produce 80-90 pounds of leaf fall used as fodder or mulched into the soil. This is a classical nutrient cycle.

Waste from feed lots such as hog, turkey and chicken farms is the best fertilizer for the trees and, in turn, the leaves are an excellent food for the animals.

Location

The area for the first tree farms will be the grid area in the image below. This grid is made up of 40 acre parcels. This image is only concerned with the alluvial fan at the south end of the development area at Laguna Salada.

However, the entire area shows only 10 miles of the potential tree farm area on this location only. It can be easily more than doubled as the alluvial fan turns northward, and other lands would allow it to be tripled or more as needed.

Mind the fact that the numbers presented below show a maximum developed area of 10 square miles of land.

The indigenous Cucapah would have multiple benefits from this tree farm regardless of the size and these plans will be used to directly benefit the Cucapah because of the use of their land and also their labors in operating these forest areas. It is they who will have the ability to benefit from intercropping and raising animals in the area.

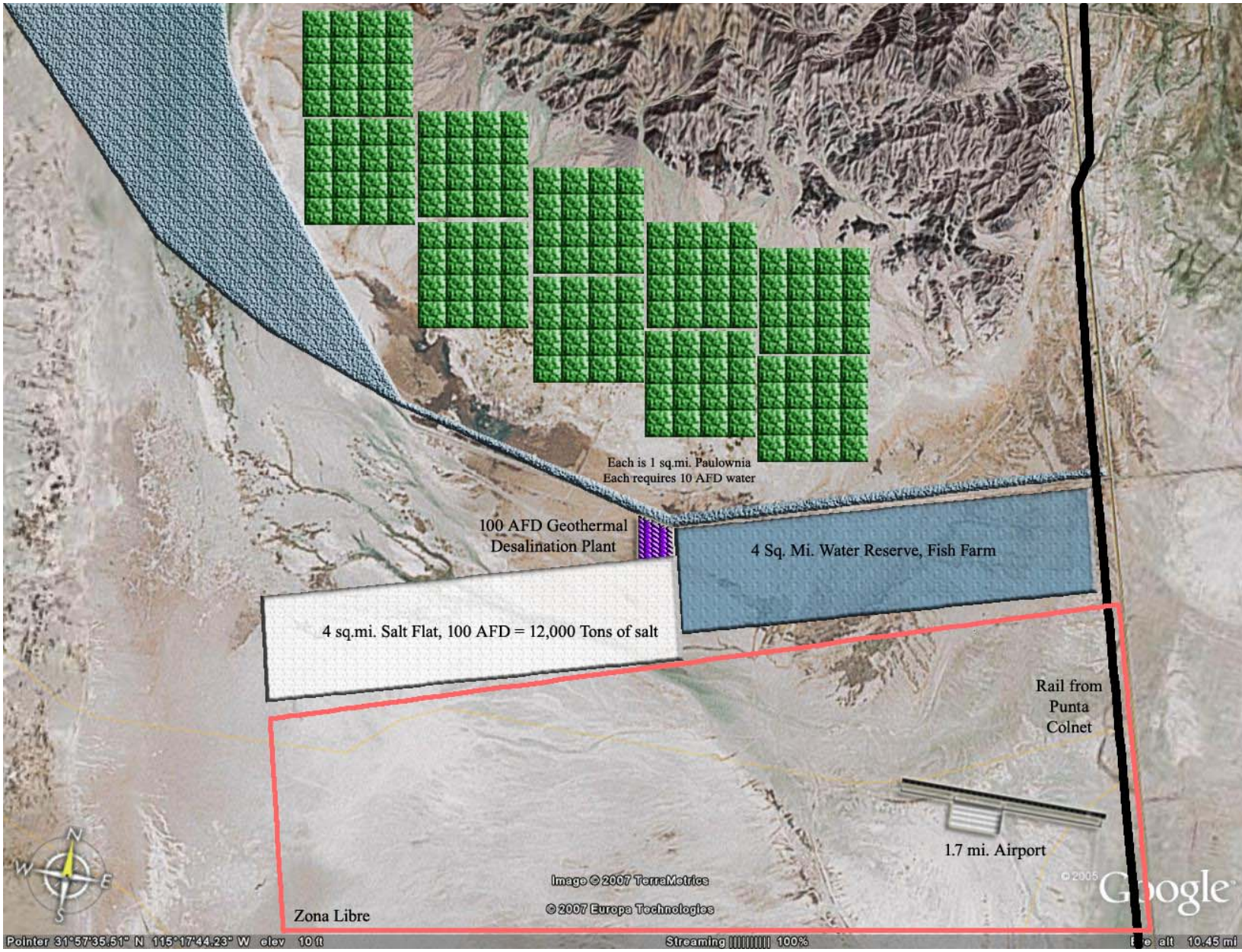
These plans will transform the lives of this extremely poor people for the foreseeable future in a manner simple to the gambling changes in American Indians. However, the plan will be laid out to benefit the people proportionally to their efforts at all levels.

Apologies for not being able to amend the images with these tree farms, however, reducing this amount of data into a small space is simply not possible. (Imaging trying to fit more than 4000 green dots into each of the 40 acre parcels illustrated below plus buildings, and so forth.)

Currently there are four distinct concepts for multi-use of these forests:

1) Cucapah dwelling places and jobs (shown below)
2) Hacienda homes (shown below)
3) Golf Resorts
4) Forest lodges

Each (except golf) will be explained in the Appendices, but the location is on the alluvial fan below where 40 acre sections are marked off.



Expand the pdf format to enlarge the images.

This is a photo of the southern portion of the alluvial fan or alluvial plane taken by the author in April of 2007.

Figure 6, Author's Photo, one alluvial fan to be developed and could be used for Paulownia Farming

While not devoid of life, the scant shrubbery which lives off the annual rainfall draining into the lagoon is typical for an area in this region with less than 2 inches of rainfall annually.

As you can see, the pitch is slight on this fan and the erosion from the rains is minimal so the ability of the Paulownia to prevent erosion is irrelevant in this location.

Figure 7, Paulownia in Bloom

Golf Resorts

The ability to create a golf experience unique to the world is another use for these forests. Cut from between the forests and in a constantly changing forest, the course changes enough from one visit to the next to be a true challenge. Local hills can be incorporated into this, especially as golf teeing ground, and ravines used as fairways as well winging up the canyons with or without trees, so the course(s) can change rapidly as one plays. The possibilities are endless and the experience completely unique. Water used on the grass also feeds the local trees and the normal use of high nitrogen fertilizer which too often runs into local run off would be readily absorbed, nor would it run into streams of to the water table in this desert environment.

Animals would inhabit the location quite naturally but also by stocking them, so, as in the Golf course at Wawona in Yosemite, dear will be seen from time to time, along with the more occasional chicken used by the forestry operations as insect control. No images yet exist of this.

Images and text relating to the other potential uses are found in Appendix 2-4.

Financial Information

The following is a basic Pro Forma income of potential profits using a two square mile plot of land. This assumes the water desalination plant is co-developed, and is at cost to this operation. Integrating this water, of course, increases the profits. However, since Mexico derives most of its profit from company profits, using simple techniques to minimize that profit reduces taxes, such as increasing the cost of the lease paid, and so forth.

Remember the size of this plot and that 8 of these can be duplicated on this alluvial plane.

Additionally, no other income is shown, so no honey, cattle, chickens, integrated fish farms, milling, or integrated furniture production, or plywood production.

Planting Pattern

When planting trees one must consider the potential growing conditions and the result on the lumber. Various configurations can be found in the table below all calculated to a one square acre plot, 43,560 sq.ft. Images above are 40 acre plots.

Pattern	Sq. Ft. per tree	Trees per acre
10x10	100	435
10x16	160	275
14x13	*182*	*239*
15x15	225	195
16 x 16	*256*	*170*
16 x 20	320	136
20x20	400	110

When considering the growth, you must consider solar ground radiance, which, in turn has many variables including latitude, elevation, atmospheric conditions, humidity (so albedo, the percentage of radiation reflected back into space), and so on. To optimize farming operations

numerous scientific studies of ground based, air based, and satellite sensors has been used to determine the radiation and this has been done in many locations in the world to determine the ultimate crop coverage in any given situation for any given crop.

In our location we have an arid desert location with low cloud coverage and humidity which maximizes solar radiation and therefore photosynthesis, therefore the density of trees which can be planted in each location.

The following map, borrowed from SunMaxx Solar illustrates this point.

This map shows solar insolation, or the amount of solar radiance received at ground level across the US. While Laguna Salada is not found, the intersecting corner of California, Arizona, and Mexico is only a few miles from this map.

This map, though undeclared on the website, is of Watts of energy reaching the ground. A Watt, of course, is a unit of energy and energy is what is needed to grow plants as Watts translate to calories of sugar which are then made into fibers for growth.

It can clearly be understood from this map that a tree density in a zone with 6 watts per foot will grow 25% faster than a tree grown in a zone with 4 Watts per foot, all other factors being equal. The same is true of density. If trees grown in Tennessee should be of a density no greater than 16’x16’ grid (solar insolation of 4.5) then growing in a solar insolation zone of 6.5, as it is here, can take a density of (6.5-4.5=2/4.5=.44, or 44%) some 44% higher, so, 170 trees per acre x1.444= 245 trees per acre is a reasonable density to expect based only on insolation.

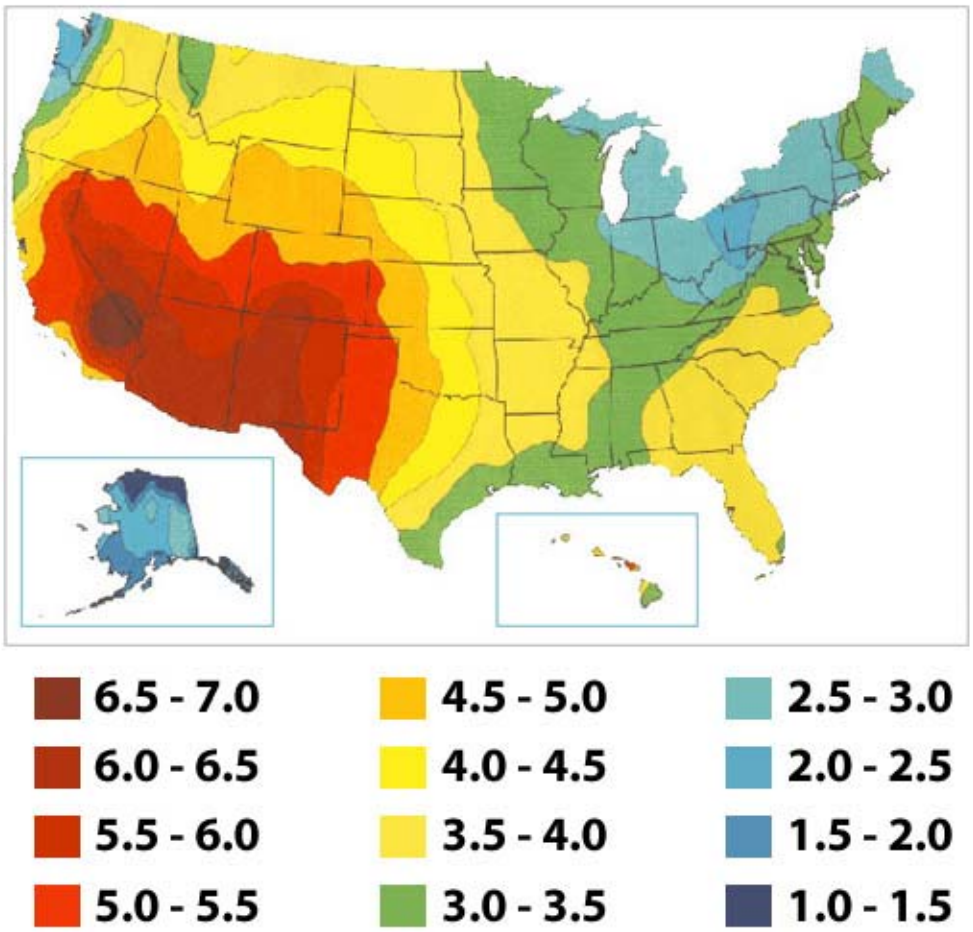


Figure 8, Watts of Sunlight per sq.ft.

Paulownia suppliers represent lumbers sales between $2-$10 per board foot for Paulownia. A board foot is 1”x12”x12.” The website: http://www.paulowniasupply.com/why_grow_paulownia_commercially.htm has the following:

*“In studies of 10 year old, fast growth Paulownia(sic) stands – average timber volume of 122 board feet per tree and sawn lumber volume of **49 board feet** or more, per tree were given.”*

Trees slow their growth as they grow taller, but if we assume 50 board feet per tree at 8 years and a density of 239 trees per acre and $3 per foot we would have $35,850 per acre gross profit.

The projected income below, the pro forma, is estimated from these numbers and other reasonable expenses.

Changes to this table from the spreadsheet are simply formatting to fit the page and colors added.

This proforma assumes 2 square miles of Paulownia and associates salt production. The bottom line is a sum of the net profits/loss.

Pro Forma Income, Cucapah Paulownia Farm 1Sq.Mi.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
REVENUE								
Land lease	(153,600)	(153,600)	(153,600)	(153,600)	(153,600)	(153,600)	(153,600)	(153,600)
Square Miles	2	2	2	2	2	2	2	2
Acres	1,280	1,280	1,280	1,280	1,280	1,280	1,280	1,280
Units (trees)	305,920	305,920	305,920	305,920	305,920	305,920	305,920	305,920
Board Foot Assumption								11,950
Price Per Foot Assumption								$3.00
Income Per Acre	-	-	-	-	-	-	-	35,850
Paulownia	-	-	-	-	-	-	-	45,888,000
Salt	35,040,000	35,040,000	35,040,000	35,040,000	35,040,000	35,040,000	35,040,000	35,040,000
Fish	1,824,000	3,648,000	5,472,000	7,296,000	9,120,000	9,120,000	9,120,000	9,120,000
TOTAL REVENUE	36,864,000	38,688,000	40,512,000	42,336,000	44,160,000	44,160,000	44,160,000	90,048,000
Cost of Goods Sold	-	38,688,000	79,200,000	121,536,000	165,696,000	209,856,000	254,016,000	344,064,000
Gross Profit	36,864,000	38,688,000	40,512,000	42,336,000	44,160,000	44,160,000	44,160,000	90,048,000
Operating Expenses								
G&A& Ovhd (TW)	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000
Site Work (AIM)	6,000,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Aqua Culture AIM	4,000,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
CMWC Desal	20,000,000							
Canal Imps (AIM)	20,000,000	2,000,000	2,000,000	2,000,000				
Planting (AIM)	10,240,000	-	-	-	-	-	-	-
Water (CMWC	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000
Tree Maintenance (AIM)	140,160	140,160	140,160	140,160	140,160	140,160	140,160	140,160
Pest Control	12,800	12,800	12,800	12,800	12,800	12,800	12,800	12,800
Accounting and Legal	15,000	15,000	15,000	15,000	15,000	15,001	15,002	15,007
Harvesting	-	-	-	-	-	-	-	2,560,000
Telephone	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Electricity	600	600	600	600	600	600	600	600
Insurance	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Taxes	-	-	-	-	-	-	-	13,507,200
Other Contingencies	1,843,200	1,934,400	2,025,600	2,116,800	2,208,000	2,208,000	2,208,000	4,502,400
Total Op. Exp.	65,077,760	7,528,960	7,620,160	7,711,360	5,802,560	5,802,561	5,802,562	24,164,167
Net Cumulative	(28,213,760)	31,159,040	32,891,840	34,624,640	38,357,440	38,357,439	38,357,438	65,883,833

Expanding Operations

Expanding these farming operations at Laguna Salada can be accomplished at multiple locations even if we only farm on alluvial fans.

As stated earlier the pro forma information above is for a two square mile farm and the alluvial fan it is on encompasses about 18 square miles and all of this land is controlled by World Wide Assets and owned by our partners, the Cucapah people.

However, there are also Ejidos which can benefit as well if they cooperate, however, this is unnecessary.

To the south of the lagoon area is an alluvia fan that covers an area best described as 5 miles long and 2 miles wide, so, some 10 square miles useful to us for raising Paulownia and utilizing water from a geothermal desalination plan which will also produce brine subjected to solar dehydration at a rate of 120 tons per acre foot of brine, 10 acre feet per day per sq.mi. or 1200 tons per day per square mile of Paulownia, 2 square miles in this illustration, therefore, 24,000 tons of salt per day.

The systems integration of the Paulownia, desalination, salt production and use of the water reserve pond to raise fish allows for a very high ROI as found above. To calculate IRR ass a zeroeth year for set up to these numbers.

These numbers can be easily multiplied up to five times at this site, and at the north end of the lagoon this total growth area can be tripled.

Appendix 1 USDA Characteristics Listing

Conservation Plant Characteristics

Paulownia tomentosa (Thunb.) Siebold & Zucc. ex Steud.
princesstree
PATO2

Summary

Duration	Perennial
Growth Habit	Tree
Native Status	L48 (I)
Federal T/E Status	
National Wetland Indicator	UPL, FACU

Morphology / Physiology

Active Growth Period	Spring and Summer
After Harvest Regrowth Rate	
Bloat	None
C:N Ratio	High
Coppice Potential	Yes
Fall Conspicuous	Yes
Fire Resistant	No
Flower Color	Purple
Flower Conspicuous	Yes
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	Yes
Growth Form	Single Crown
Growth Rate	Rapid
Height at 20 Years, Maximum (feet)	60
Height, Mature (feet)	70
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	
Resprout Ability	Yes

Shape and Orientation	Irregular
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	Medium
Fertility Requirement	Medium
Fire Tolerance	
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	4.5
pH, Maximum	7.5
Planting Density per Acre, Minimum	400
Planting Density per Acre, Maximum	800
Precipitation, Minimum	30
Precipitation, Maximum	55
Root Depth, Minimum (inches)	36
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-8

Reproduction

Bloom Period	Mid Spring
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Low
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	Yes
Propagated by Bare Root	Yes
Propagated by Bulb	No
Propagated by Container	Yes
Propagated by Corm	No
Propagated by Cuttings	Yes
Propagated by Seed	Yes

Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	2820000
Seed Spread Rate	Slow
Seedling Vigor	High
Small Grain	No
Vegetative Spread Rate	None

Suitability / Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	No
Fuelwood Product	Medium
Lumber Product	Yes
Naval Store Product	Yes
Nursery Stock Product	Yes
Palatable Browse Animal	
Palatable Graze Animal	
Palatable Human	No
Post Product	No
Protein Potential	
Pulpwood Product	No
Veneer Product	No

From: http://plants.usda.gov/java/charProfile?symbol=PATO2

Appendix 2 Cucapah Housing and Jobs

The plan from the very inception included housing for the Cucapah, to give them a place that was uncrowded, where land rights were clearly delineated, and where they could have fresh water and fishing rights.

However, when the concept of raising Paulownia was developed this concept evolved into planting Paulownia in the same location as the planed Cucapah housing which immediately suggested their participation with the foresting operations.

By having a home in the Paulownia and using localized septic for those people, you introduce organic matter into the soils which are beneficial to the soils and to the trees.

While providing water to the trees it is a small matter to provide that same water to the people living in the area and caring for those trees.

The image below shows this concept, and, again, in pdf format can be expanded to show more detail.

In this image a pattern of a 10’x10’ grid for trees is laid out as is a grid for water distribution. The distribution itself is easily accomplished using automated control boxes distributing water into pipes which are simply cut at the top to allow water to flow in and fall out to the soil below. These are capped at the end to build a slight pressure and prevent the water from exiting in one location.

Radio controlled flow and regulation of the water is thusly accomplished.

In this you see a home, a basic home to start, where each family has 600 to 800 sq. ft. to live in. This can be expanded at will but creates a basic design to work from.

The Cucapah will be provided a healthy living wage for attending the trees, and profits to the companies involved will be expected to be between 18% and 28% annualized ROI.

The blue lines to the bottom and right are water distribution lines. The house is in the bottom right corner. Also illustrated are two trucks monitoring the water and trees.

There will be a long term land lease executed by the company involved to pay the Cucapah for tending the trees and training provided to them as to how that is to be done. They will be able to raise other animals in this area as well.

The following map illustrates on 40 acre parcel.

Appendix 3 Hacienda Homes

Hacienda homes, as outlined in the main business plan are located on 40 acre plots. What has changed is that each plot is not planted with Paulownia trees, the house site is roughly in the center and the owners are expected to support three families: one for domestic support, one to tend the farms, and one as gate security.

Allowances are made for fruit trees, illustrated here (below) above the home site, and the house and land site, being premium sites, are sold (land lease) at a premium with the expectation of a 15 year payback.

This allows for tremendous flexibility on how these are treated at tax time and how individuals and companies will purchase them.

Remember, this is also a business. Travel to and from the business can be tax deductable as can other expenses including the business set-up fees, i.e. the cost of the entire operation. If there is an office in the facility this too provides tax relief.

There is a benefit to owning a carbon sink for businesses concerned about Carbon Credits and the company may want to take those carbon credits for themselves. Corporations will want to expand operations to include the investment in these operations.

There is the philanthropic aspect to the operation, supporting three poor families in Mexico with more than a low wage, rather, a healthy living wage will be required and specified in the lease. The idea is to take three families out of object poverty, not to take advantage of them and leave them in poverty. They need to be paid sufficiently that leaving the ranch would be unthinkable for most until and unless they receive sufficient education to expand their world. You also do not want to continually retrain people to replace those who have moved on. Being this close to the United States, moving on to cross the border can be tempting, so paying them enough to make staying the larger temptation is in fact the right thing to do for all concerned.

The area remaining will produce sufficient income from the Paulownia trees less expenses to repay the entire investment and expenses in 15 years. The water prices will be adjusted for this target or an agreed upon target.

Appendix 4 Hunters Lodge

Hunting lodges, forest lodges, and cabins can exist in these forests. Illustrated below is a hunting lodge where hunting enthusiasts can venture out for birds and dear, using shotguns or bow and arrows in the appropriate season.

While this image, like the others, assumes a 40 acre site, much more likely would be a single lodge on 320 acres.

As shown we anticipate, say, 150 rooms and 5 suites on the 4 story property with plenty of room for expansion. But where else can you hunt dove or pheasant in the morning, water ski in a lagoon at noon, then have live entertainment and fine dining on the waterfront at night?

Other non-hunting lodges can also be created using other themes. Simple hotels with individual log cabins as rooms. Log cabins not only create an incredible visual atmosphere, but are remarkable insulated and the inside can always be kept at a cool 70 degrees.

As illustrated here, we show housing for the workers in the lodge as well. This is, of course, a classical lodge made of Paulownia logs and local rock. But then, what would you expect?

References:

Aiken, G.R., P. MacCarthy, R. L. Malcolm and R. S. Swift, Humic Substances in Soil, Sediment, and Water, Wiley, New York, 1985.

Asai, T., N. Hara, S. Kobayashi, S. Kohshima, Y. Fijimoto, 2008. Geranylated flavanones from the secretion on the surface of the immature fruits of Paulownia tomentosa. Phytochemistry 69 (2008) 1234–1241

Caparros, S. M.J. Diaz, J. Ariza, F. Lopez, L. Jimenez, 2007. New perspectives for Paulownia fortunei L. valorization of the autohydrolysis and pulping processes. Bioresource Technology 99 (2008) 741–749

G. Davies and E. A. Ghabbour, Humic Substances: Structures, Properties and Uses, Royal Society of Chemistry, Cambridge, 1998.

Gaffney, J. S., N. A. Marley and S. B. Clark, Humic and Fulvic Acids: Isolation, Structure and Environmental Role, American Chemical Society Symposium Series 651, 1996.

Hayes, M.H.B. and W. S. Wilson, Humic Substances, Peats and Sludges: Health and Environmental Aspects, Royal Society of Chemistry, Cambridge, 1997.

http://www.paulowniasupply.com/why_grow_paulownia_commercially.htm

Li, Peng, and Juhachi Oda, Flame retardency of Paulownia wood and its mechanism, Journal of Material Science (2007) 42:8544-8550, DOI 10.1007/s10853-007-1781-9

Liao, L., Hu Mei, Jianfeng Li, Zhiliang Li, 2008. Estimation and prediction on retention times of components from essential oil of Paulownia tomentosa flowers by molecular electronegativity-distance vector (MEDV). Journal of Molecular Structure: THEOCHEM 850 (2008) 1–8

MacCarthy, P., C. E. Clapp, R. L. Malcolm and R. R. Bloom, Humic Substances in Soil and Crop Sciences: Selected Readings, American Society of Agronomy, Madison, Wisconsin, 1990.

Senesi, N. and T. M. Miano, Humic Substances in the Global Environment: Implications for Human Health, Elsevier, Amsterdam, 1994.

Stevenson, F. J., Humus Chemistry: Genesis, Composition, Reactions, 2nd edn., Wiley, New York, 1994.