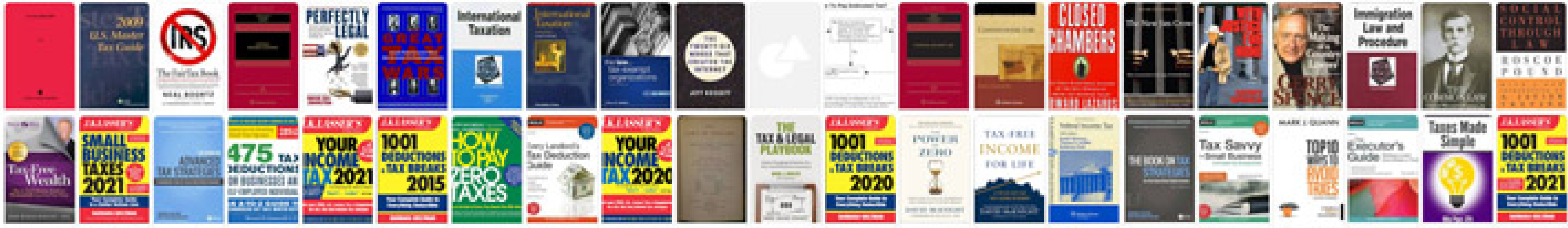

Swamp diagram

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Evaporative coolers , often known as swamp coolers , work by extremely simple physics: As water evaporates, it effectively "consumes" heat from the surrounding air. It is the same principle by which an air fan cools you as it evaporates perspiration from your skin. The parts of an evaporative cooler are all designed to facilitate efficient evaporation of water and circulation of the cooled air into the home. Here is a rundown of the anatomy of an evaporative cooler. Some parts may need to be replaced often, while others may last the full life of the appliance. The motors on evaporative coolers usually work fine until they don'tâ€”they don't gradually decline. If you are changing the motor in an evaporative cooler, make sure you examine the current motor to see what size it is and how many speeds it has. Changing the motor on a cooler is not a difficult project, but it does require some basic electrical know-how to connect the wires. Don't try this unless you are confident in those skills. The bearings are the small round metal spheres that allow the drive shaft on the blower to spin smoothly when driven by the motor. The blower shaft spins constantly on the bearings, so if the bearings are going bad, the appliance often makes a piercing, squeaking sound. Sometimes this sound can be remedied by lubricating the bearings. If you have any doubts about which kind you have, bring the old bearings along when buying the replacements. To access the bearings for lubrication or replacement, you will need to disassemble the drive shaft. Again, this is a job possible for a skilled DIYer, but don't tackle it if you're not confident. The pulleys rarely go bad, but if necessary they can be removed by loosening the Allen screws that hold them in place. Using a different-sized pulley could put unnecessary stress on the motor and affect how the cooler runs. It is a good idea to check the motor pulley periodically for dents and alignment. Motor pulleys come in different sizes for different-sized motors. When replacing the motor pulley with an adjustable one, be sure to set the adjustment to the motor specific size. The other pulley found in an evaporative cooler is the blower pulley, which is positioned lower on the unit, in line with the blower shaft. As with the motor pulley, the blower pulley must be the correct size to ensure that the swamp cooler works correctly. The V-belt is a long-lasting type of drive belt. Its design makes for minimal slippage in the pulleys and it is easy on the bearings, making it a good choice for evaporative coolers. The V-belt can stretch and become loose in the pulleys, however, and it eventually wears out. And the V-belt must be aligned straight to work effectively. When inspecting the V-belt, check the pulley positioning and adjust as necessary so that the pulleys are correctly aligned for straight movement of the belt. Also check the V-belt tension, making sure it matches the manufacturer's recommendations. V-belts come in a variety of sizes, so if you are replacing one, take care to choose the right size. If the belt is beginning to crack, it may be a good idea to replace it before it breaks. The water pump in an evaporative cooler brings the water from the pan to the distribution tubing, and from there onto the pads. The evaporation of water from the pads is what allows the appliance to cool the air, so if the pads are not being saturated with water, the pump may need to be replaced. If the pump is operating correctly but does not keep the cooler pads wet enough, you may want to upsize the pump to a larger one that can move more water. The drain is a hollow tube that is mounted in the bottom of the cooler pan. Excess water will go up and over the drain tube and spill onto the ground, alerting you to the fact that there is a problem. The float valve sits in the cooler pan and regulates the height of the water. It works in much the same way as the float ball or float cup in a toilet tank. The float valve rises and falls with the water level and its lever shuts off the water supply when the water in the pan reaches the required level. The water level must be high enough so that the pump can draw water up to the evaporative pads, but not so high that the water flows into the overflow tube. Adjusting the water to the right height is usually just a matter of manually bending the float rod until the water shuts off at the proper level. You can replace a float valve in a few minutes with parts that cost just a few dollars. The pads are where the air cooling occurs, as water delivered to the pads by the water pump evaporates under the air blown through the pads by the cooler motor. The most common and cheapest cooler pads are the ones made from wood strips. These pads work well, but if the strips get loose, they can clog up the pump, so placing an extra screen around the pump can be a good idea. Evaporative pads also come in a variety of sizes, so take measurements of the inside of the cooler panels when buying new pads. Cooler pads should be changed each year, either when you winterize or de-winterize the cooler. The distribution tubing, commonly called the spider , distributes the water from the pump to the cooler pads. The tubing can sometimes get clogged, and it may require cleaning or even replacement if you're not getting enough water out of it. The wire connection box is where the main power supply comes into the cooler. There normally is not much repair needed at the wire connection box, except possibly to check the wiring connections and tighten any loose ones. In This Article Expand. Shaft Bearings. Motor Pulley. Blower Pulley. Water Pump. Drain and Overflow Tube. Float Valve. Evaporative Pads. Distribution Tubing. Wire Connection Box. Read More. This lists the logos of programs or partners of NG Education which have provided or contributed the content on this page. Powered by. A swamp is an area of land permanently saturated, or filled, with water. Many swamps are even covered by water. There are two main types of swamps: freshwater swamps and saltwater swamps. Swamps are dominated by trees. They are often named for the type of trees that grow in them, such as cypress swamps or hardwood swamps. Freshwater swamps are commonly found inland, while saltwater swamps are usually found along coastal areas. Swamps are transition areas. They are neither totally land nor totally water. Swamps exist in many kinds of climates and on every continent except Antarctica. They vary in size from isolated prairie potholes to huge coastal salt marshes. Some swamps are flooded woodlands. Some are former lakes or ponds overtaken by trees and shrubs. Freshwater Swamps Freshwater swamps form around lakes and streams. Rain and seasonal flooding cause water levels to fluctuate. In the wet soil , water-tolerant vegetation grows and helps maintain a moist, swampy condition. In many freshwater swamps in the southeastern United States, cypress and tupelo trees grow. Spanish moss may hang from the branches, and tiny plants called duckweed may cover the waters surface. Shrubs and bushes may grow beneath the trees. Sometimes poking as much as 4 meters 13 feet above the water are angular knobs called cypress knees. They are outgrowths of the trees' root systems. Alligators, frogs, and many other animals live in these swamps. These animals are adapted to fluctuating water levels. The shadowy tree root system and cypress knobs provide a rich, sheltered habitat for nesting birds, as well as fish, amphibians and reptiles. The freshwater swamps between the Tigris and Euphrates Rivers in the Middle East are so rich in biodiversity that the area is called the " Fertile Crescent. The Fertile Crescent is recognized as the birthplace of civilization and the site of the first cities. The earliest recorded written language and the first recorded use of the wheel occurred around these swamps. The Everglades , in Florida, is one of the largest swamp complexes in the United States. Called the " River of Grass ," this freshwater swamp is actually a wide, slow-moving river flowing from the Kissimmee River near Orlando to the Straits of Florida. The Everglades is 97 kilometers 60 miles wide and kilometers miles long. A rich collection of wildlife, from alligators to panthers, calls this freshwater swamp home. Saltwater Swamps Saltwater swamps form on tropical coastlines. Formation of these swamps begins with bare flats of mud and sand that are thinly covered by seawater during high tides. Plants that are able to tolerate tidal flooding, such as mangrove trees, begin to grow and soon form thickets of roots and branches. Mangrove trees often grow on tall, thin roots. The roots anchor sand and other sediments. The growth and decay of the roots increase the accumulation of soil. Among these mangroves live animals that feed on fallen leaves and other material. Crabs, conchs, and other shellfish are abundant in mangrove swamps. The swamps are also home to a huge variety of birds, whose droppings help fertilize the swamp. Because the young of many marine animals find food and shelter in saltwater swamps, these wetlands are sometimes called the nurseries of the ocean. Many ocean species enter coastal wetlands to spawn. Fish swim into salt marshes to lay their eggs. When the eggs hatch, the young find plenty of food and some protection in swamp grasses or among tree roots. Other species spawn in the ocean, and the young swim into the wetlands and live there until they mature. People and swamps Swamps are among the most valuable ecosystems on Earth. They act like giant sponges or reservoirs. When heavy rains cause flooding, swamps and other wetlands absorb excess water, moderating the effects of flooding. Swamps also protect coastal areas from storm surges that can wash away fragile coastline. Saltwater swamps and tidal salt marshes help anchor coastal soil and sand. The swamp ecosystem also acts as a water treatment plant, filtering wastes and purifying water naturally. When excess nitrogen and other chemicals wash into swamps, plants there absorb and use the chemicals. Many of these chemicals come from human activities such as agriculture , where fertilizers use nitrogen and phosphorus. Factories, water treatment plants, and homes also contribute to runoff. Chemicals not absorbed by plants slowly sink to the bottom and are buried in sand and sediment. For most of history, wetlands were looked upon as wastelands, and as homes for insect pests such as mosquitoes. Swamps are home to a wide variety of insects, which feed on the wide variety of plants. People thought swamps were sinister and forbidding. In the United States, filling or draining swamps was an accepted practice. Almost half of U. Most of the Everglades have been reclaimed as agricultural land, mostly sugar plantations. Federal and state authorities drained much of the wetlands at the delta of the Mississippi River in Louisiana as part of a massive system of river management. When Hurricane Katrina blew in from the Gulf of Mexico in , the spongy swamp that traditionally protected the city of New Orleans from destructive weather patterns was diminished. The city was hit full force with a Category 3 hurricane. Eradicating swampland also threatens economic activity. Two-thirds of the fish and shellfish that are commercially harvested worldwide are linked with wetlands. From Brazils varzeas, or freshwater swamps surrounding the Amazon

River, to saltwater swamps near the Florida Keys, commercially valuable fish species that depend on wetlands are threatened with extinction. In the early s, governments began enacting laws recognizing the enormous value of swamps and other wetlands. In some parts of the United States, it is now against the law to alter or destroy swamps. Through management plans and stricter laws, people are trying to protect remaining swamps and to re-create them in areas where they have been destroyed. Photograph by Joseph Guillory , My Shot. Pogo One of the most important American satires of the 20th century took place in the Georgia section of the Okefenokee Swamp. Pogo , created by writer and artist Walt Kelly, was a comic strip that ran from During that time, the comic satirized American politicians like Sen. Joseph McCarthy as a character called "Simple J. Pogo 's characters were animals native to the Okefenokee Swamp: alligators, owls, skunks, and the title character, Pogo, an opossum. During the first Earth Day, in , Pogo looked out on his garbage-infested swamp home and sighed, "We have met the enemy, and he is us. Okefenokee Swamp Okefenokee is a Native American word that means "trembling earth. Coal From Swamps Ancient swamps are a source of the fossil fuel coal. Coal is formed from plants that died millions of years ago. The plant matter settled in layers at the bottom of swamps, where lack of oxygen kept it from decaying completely. Over time, pressure from accumulating layers caused the vegetation to harden, or fossilize, into coal. For centuries, coal has been burned and used as fuel. Deposits of this fossil fuel can be found on every continent. Everglades, a vast swampy region flowing south of Lake Okeechobee in the U. Spanish moss is not a moss. Also called a storm tide. The audio, illustrations, photos, and videos are credited beneath the media asset, except for promotional images, which generally link to another page that contains the media credit. The Rights Holder for media is the person or group credited. Caryl-Sue, National Geographic Society. Dunn, Margery G. For information on user permissions, please read our Terms of Service. If you have questions about licensing content on this page, please contact ngimagecollection natgeo. If you have questions about how to cite anything on our website in your project or classroom presentation, please contact your teacher. She or he will best know the preferred format. When you reach out to him or her, you will need the page title, URL, and the date you accessed the resource. If a media asset is downloadable, a download button appears in the corner of the media viewer. If no button appears, you cannot download or save the media. Text on this page is printable and can be used according to our Terms of Service. Any interactives on this page can only be played while you are visiting our website. You cannot download interactives. Climate describes the average weather conditions of a particular place over a 30 year period. All places on earth have their own climates. Different from weather events, which are short-term and temporary phenomenon, climates are usually steady and predictable, and shape how organisms and human civilizations evolve and adapt in any given region. However, climates are not always permanent, and can change drastically due to human activity. Explore the world's climates and how they affect local regions and the planet with this curated collection of resources. A biome is an area classified according to the species that live in that location. Temperature range, soil type, and the amount of light and water are unique to a particular place and form the niches for specific species allowing scientists to define the biome. However, scientists disagree on how many biomes exist. Some count six forest, grassland, freshwater, marine, desert, and tundra , others eight separating two types of forests and adding tropical savannah , and still others are more specific and count as many as 11 biomes. Use these resources to teach middle school students about biomes around the world. Their bodies are powerful in dry terrains but are not built for high-speed races in the water. Encyclopedic entry. A wetland is an area of land that is either covered by water or saturated with water. Join our community of educators and receive the latest information on National Geographic's resources for you and your students. Skip to content. Twitter Facebook Pinterest Google Classroom. Encyclopedic Entry Vocabulary. Swamps are usually humid places. Euphrates River. Fertile Crescent. Fossil fuels formed from the remains of ancient plants and animals. Hurricane Katrina. River of Grass. Spanish moss. Tigris River. Media Credits The audio, illustrations, photos, and videos are credited beneath the media asset, except for promotional images, which generally link to another page that contains the media credit. Last Updated Jan. Media If a media asset is downloadable, a download button appears in the corner of the media viewer. Text Text on this page is printable and can be used according to our Terms of Service. Interactives Any interactives on this page can only be played while you are visiting our website. Related Resources. View Collection. View Photograph. Swamp Lion Defeated by Swamp. View Video. View Article. Educational Resources in Your Inbox. Educational Resources in Your Inbox Join our community of educators and receive the latest information on National Geographic's resources for you and your students. An evaporative cooler also evaporative air conditioner , swamp cooler , swamp box , desert cooler and wet air cooler is a device that cools air through the evaporation of water. Evaporative cooling differs from other air conditioning systems, which use vapor-compression or absorption refrigeration cycles. Evaporative cooling uses the fact that water will absorb a relatively large amount of heat in order to evaporate that is, it has a large enthalpy of vaporization. The temperature of dry air can be dropped significantly through the phase transition of liquid water to water vapor evaporation. This can cool air using much less energy than refrigeration. In extremely dry climates, evaporative cooling of air has the added benefit of conditioning the air with more moisture for the comfort of building occupants. The cooling potential for evaporative cooling is dependent on the wet-bulb depression, the difference between dry-bulb temperature and wet-bulb temperature see relative humidity. In arid climates , evaporative cooling can reduce energy consumption and total equipment for conditioning as an alternative to compressor-based cooling. In climates not considered arid, indirect evaporative cooling can still take advantage of the evaporative cooling process without increasing humidity. Passive evaporative cooling strategies can offer the same benefits of mechanical evaporative cooling systems without the complexity of equipment and ductwork. An earlier form of evaporative cooling, the windcatcher , was first used in ancient Egypt and Persia thousands of years ago in the form of wind shafts on the roof. They caught the wind, passed it over subterranean water in a qanat and discharged the cooled air into the building. The evaporative cooler was the subject of numerous US patents in the 20th century; many of these, starting in , [2] suggested or assumed the use of excelsior wood wool pads as the elements to bring a large volume of water in contact with moving air to allow evaporation to occur. A typical design, as shown in a patent, includes a water reservoir usually with level controlled by a float valve , a pump to circulate water over the excelsior pads and a centrifugal fan to draw air through the pads and into the house. Externally mounted evaporative cooling devices car coolers were used in some automobiles to cool interior airâ€”often as aftermarket accessories [6] â€”until modern vapor-compression air conditioning became widely available. Passive evaporative cooling techniques in buildings have been a feature of desert architecture for centuries, but Western acceptance, study, innovation, and commercial application is all relatively recent. In , William H. Goettl noticed how evaporative cooling technology works in arid climates, speculated that a combination unit could be more effective, and invented the "High Efficiency Astro Air Piggyback System", a combination refrigeration and evaporative cooling air conditioner. In , University of Arizona researchers W. Cunningham and T. Thompson built a passive evaporative cooling tower, and performance data from this experimental facility in Tucson, Arizona became the foundation of evaporative cooling tower design guidelines developed by Baruch Givoni. Evaporative coolers lower the temperature of air using the principle of evaporative cooling, unlike typical air conditioning systems which use vapor-compression refrigeration or absorption refrigeration. Evaporative cooling is the conversion of liquid water into vapor using the thermal energy in the air, resulting in a lower air temperature. The energy needed to evaporate the water is taken from the air in the form of sensible heat , which affects the temperature of the air, and converted into latent heat , the energy present in the water vapor component of the air, whilst the air remains at a constant enthalpy value. This conversion of sensible heat to latent heat is known as an isenthalpic process because it occurs at a constant enthalpy value. Evaporative cooling therefore causes a drop in the temperature of air proportional to the sensible heat drop and an increase in humidity proportional to the latent heat gain. Evaporative cooling can be visualized using a psychrometric chart by finding the initial air condition and moving along a line of constant enthalpy toward a state of higher humidity. A simple example of natural evaporative cooling is perspiration , or sweat, secreted by the body, evaporation of which cools the body. The evaporation rate depends on the temperature and humidity of the air, which is why sweat accumulates more on humid days, as it does not evaporate fast enough. Vapor-compression refrigeration uses evaporative cooling, but the evaporated vapor is within a sealed system, and is then compressed ready to evaporate again, using energy to do so. A simple evaporative cooler's water is evaporated into the environment, and not recovered. In an interior space cooling unit, the evaporated water is introduced into the space along with the now-cooled air; in an evaporative tower the evaporated water is carried off in the airflow exhaust. A closely related process, sublimation cooling , differs from evaporative cooling in that a phase transition from solid to vapor , rather than liquid to vapor, occurs. Sublimation cooling has been observed to operate on a planetary scale on the planetoid Pluto , where it has been called an anti-greenhouse effect. Another application of a phase change to cooling is the "self-refrigerating" beverage can. A separate compartment inside the can contains a desiccant and a liquid. Just before drinking, a tab is pulled so that the desiccant comes into contact with the liquid and dissolves. As it does so, it absorbs an amount of heat energy called the latent heat of fusion. Evaporative cooling works with the phase change of liquid into vapor and the latent heat of vaporization , but the self-cooling can uses a change from solid to liquid, and the latent heat of fusion, to achieve the same result. Before the advent of modern refrigeration, evaporative cooling was used for millennia, for instance in qanats , windcatchers , and mashrabiyas. Alternatively, a bowl filled with milk or butter could be placed in another bowl filled with water, all being covered with a wet cloth resting in the water, to keep the milk or butter as fresh as possible see zeer , botijo and Coolgardie safe. Evaporative cooling is a common form of cooling buildings for thermal comfort since it is relatively cheap and requires less energy than other forms of cooling. The figure showing the Salt Lake City weather data represents the typical summer climate June to September. The colored lines illustrate the potential of direct and indirect evaporative cooling strategies to expand the comfort range in summer time. It is mainly explained by the combination of a higher air speed on one hand and elevated indoor humidity when the region permits the direct evaporative cooling strategy on the other hand. Evaporative cooling strategies that involve the humidification of the air should be implemented in dry condition where the increase in moisture content stays below recommendations for occupant's comfort and indoor air quality. Passive cooling towers lack the control that traditional HVAC systems offer to occupants. However, the additional air movement provided into the space can improve occupant comfort. Evaporative cooling is most effective when the relative humidity is on the low side, limiting its popularity to dry climates. Evaporative cooling raises the internal humidity level significantly, which desert inhabitants may appreciate as the moist air re-hydrates dry skin and sinuses. Therefore, assessing typical climate data is an essential procedure to determine the potential of evaporative cooling strategies for a building. The three most important climate considerations are dry-bulb temperature , wet-bulb temperature , and wet-bulb depression during a typical summer day. It is important to determine if the wet-bulb depression can provide sufficient cooling during the summer day. By subtracting the wet-bulb depression from the outside dry-bulb temperature, one can estimate the approximate air temperature leaving the evaporative cooler. It is important to consider that the ability for the exterior dry-bulb temperature to reach the wet-bulb temperature depends on the saturation efficiency. Despite the lower temperature, evaporative cooling is suitable for similar climates to Salt Lake City. Evaporative cooling is especially well suited for climates where the air is hot and humidity is low. Evaporative air conditioning is also popular and well-suited to the southern temperate part of Australia. However, evaporative cooling and vapor-compression air conditioning are sometimes used in combination to yield optimal cooling results. Some evaporative coolers may also serve as humidifiers in the heating season. In regions that are mostly arid, short periods of high humidity may prevent evaporative cooling from being an effective cooling strategy. An example of this event is the monsoon season in New Mexico and central and southern Arizona in July and August. In locations with moderate humidity there are many cost-effective uses for evaporative cooling, in addition to their widespread use in dry climates. For example, industrial plants, commercial kitchens, laundries , dry cleaners , greenhouses , spot cooling loading docks, warehouses, factories, construction sites, athletic events, workshops, garages, and kennels and confinement farming poultry ranches, hog, and dairy often employ evaporative cooling. In highly humid climates, evaporative cooling may have little thermal comfort benefit beyond the increased ventilation and air movement it provides. Trees transpire large amounts of water through pores in their leaves called stomata , and through this process of evaporative cooling, forests interact with climate at local and global scales. Several hot and dry regions throughout the world could potentially benefit from evaporative cooling, including North Africa, the Sahel region of Africa, the Horn of Africa, southern Africa, the Middle East, arid regions of South Asia, and Australia. Benefits of evaporative cooling chambers for many rural communities in these regions include reduced post-harvest loss, less time spent traveling to the market, monetary savings, and increased availability of vegetables for consumption. Evaporative cooling is commonly used in cryogenic applications. The vapor above a reservoir of cryogenic liquid is pumped away, and the liquid continuously evaporates as long as the liquid's vapor pressure is significant. Evaporative cooling of ordinary helium forms a 1-K pot , which can cool to at least 1. Evaporative cooling of helium-3 can provide temperatures below mK. These techniques can be used to make cryocoolers , or as components of lower-temperature cryostats such as dilution refrigerators. As the temperature decreases, the vapor pressure of the liquid also falls, and cooling becomes less effective. This sets a lower limit to the temperature attainable with a given liquid. Evaporative cooling is also the last cooling step in order to reach the ultra-low temperatures required for Boseâ€"Einstein condensation BEC. Here, so-called forced evaporative cooling is used to selectively remove high-energetic "hot" atoms from an atom cloud until the remaining cloud is cooled below the BEC transition temperature. Although robotic spacecraft use thermal radiation almost exclusively, many manned spacecraft have short missions that permit open-cycle evaporative cooling. Examples include the Space Shuttle

, the Apollo command and service module CSM , lunar module and portable life support system. The Apollo spacecraft used sublimators , compact and largely passive devices that dump waste heat in water vapor steam that is vented to space. The water expended is often available in surplus from the fuel cells used by many manned spacecraft to produce electricity. Most designs take advantage of the fact that water has one of the highest known enthalpy of vaporization latent heat of vaporization values of any common substance. Because of this, evaporative coolers use only a fraction of the energy of vapor-compression or absorption air conditioning systems. Unfortunately, except in very dry climates, the single-stage direct cooler can increase relative humidity RH to a level that makes occupants uncomfortable. Indirect and two-stage evaporative coolers keep the RH lower. Direct evaporative cooling open circuit is used to lower the temperature and increase the humidity of air by using latent heat of evaporation, changing liquid water to water vapor. In this process, the energy in the air does not change. Warm dry air is changed to cool moist air. The heat of the outside air is used to evaporate water. The moist air has to be continually released to outside or else the air becomes saturated and evaporation stops. A mechanical direct evaporative cooler unit uses a fan to draw air through a wetted membrane, or pad, which provides a large surface area for the evaporation of water into the air. Water is sprayed at the top of the pad so it can drip down into the membrane and continually keep the membrane saturated. Any excess water that drips out from the bottom of the membrane is collected in a pan and recirculated to the top. Single-stage direct evaporative coolers are typically small in size as they only consist of the membrane, water pump, and centrifugal fan. The mineral content of the municipal water supply will cause scaling on the membrane, which will lead to clogging over the life of the membrane. Depending on this mineral content and the evaporation rate, regular cleaning and maintenance is required to ensure optimal performance. Generally, supply air from the single-stage evaporative cooler will need to be exhausted directly one-through flow because the high humidity of the supply air. A few design solutions have been conceived to utilize the energy in the air, like directing the exhaust air through two sheets of double glazed windows, thus reducing the solar energy absorbed through the glazing. Passive direct evaporative cooling can occur anywhere that the evaporatively cooled water can cool a space without the assist of a fan. This can be achieved through use of fountains or more architectural designs such as the evaporative downdraft cooling tower, also called a "passive cooling tower". The passive cooling tower design allows outside air to flow in through the top of a tower that is constructed within or next to the building. The outside air comes in contact with water inside the tower either through a wetted membrane or a mister. As water evaporates in the outside air, the air becomes cooler and less buoyant and creates a downward flow in the tower. At the bottom of the tower, an outlet allows the cooler air into the interior. Similar to mechanical evaporative coolers, towers can be an attractive low-energy solution for hot and dry climate as they only require a water pump to raise water to the top of the tower. For arid climates with a great wet-bulb depression, cooling towers can provide enough cooling during summer design conditions to be net zero. For the Zion National Park visitors' center, which uses two passive cooling towers, the cooling energy intensity was Indirect evaporative cooling closed circuit is a cooling process that uses direct evaporative cooling in addition to some heat exchanger to transfer the cool energy to the supply air. The cooled moist air from the direct evaporative cooling process never comes in direct contact with the conditioned supply air. The moist air stream is released outside or used to cool other external devices such as solar cells which are more efficient if kept cool. This is done to avoid excess humidity in enclosed spaces, which is not appropriate for residential systems. One indirect cooler manufacturer uses the Maisotsenko cycle M-Cycle , named after inventor and Professor Dr. Valeriy Maisotsenko, employs an iterative multi-step heat exchanger made of a thin recycleable membrane that can reduce the temperature of product air to below the wet-bulb temperature, and can approach the dew point. The system has very high efficiency but, like other evaporative cooling systems, is constrained by the ambient humidity levels, which has limited its adoption for residential use. It may be used as supplementary cooling during times of extreme heat without placing significant additional burden on electrical infrastructure. If a location has excess water supplies or excess desalination capacity it can be used to reduce excessive electrical demand by utilizing water in affordable M-Cycle units. Due to high costs of conventional air conditioning units and extreme limitations of many electrical utility systems, M-Cycle units may be the only appropriate cooling systems suitable for impoverished areas during times of extremely high temperature and high electrical demand. In developed areas, they may serve as supplemental backup systems in case of electrical overload, and can be used to boost efficiency of existing conventional systems. The M-Cycle is not limited to cooling systems and can be applied to various technologies from Stirling engines to Atmospheric water generators. For cooling applications it can be used in both cross flow and counterflow configurations. Counterflow was found to obtain lower temperatures more suitable for home cooling, but cross flow was found to have a higher coefficient of performance COP , and is therefore better for large industrial installations. Unlike traditional refrigeration techniques, the COP of small systems remains high, as they do not require lift pumps or other equipment required for cooling towers. This does not take into account the energy required to purify or deliver the water, and is strictly the power required to run the device once water is supplied. Though desalination of water also presents a cost, the latent heat of vaporization of water is nearly times higher than the energy required to purify the water itself. However, regardless of these losses, the effective COP is still significantly higher than a conventional cooling system, even if water must first be purified by desalination. In areas where water is not available in any form, it can be used with a desiccant to recover water using available heat sources, such as solar thermal energy. Still, the relatively dry air resulting from indirect evaporative cooling allows inhabitants' perspiration to evaporate more easily, increasing the relative effectiveness of this technique. Indirect Cooling is an effective strategy for hot-humid climates that cannot afford to increase the moisture content of the supply air due to indoor air quality and human thermal comfort concerns. Passive indirect evaporative cooling strategies are rare because this strategy involves an architectural element to act as a heat exchanger for example a roof. This element can be sprayed with water and cooled through the evaporation of the water on this element. These strategies are rare due to the high use of water, which also introduces the risk of water intrusion and compromising building structure. In the first stage of a two-stage cooler, warm air is pre-cooled indirectly without adding humidity by passing inside a heat exchanger that is cooled by evaporation on the outside. In the direct stage, the pre-cooled air passes through a water-soaked pad and picks up humidity as it cools. Since the air supply is pre-cooled in the first stage, less humidity is transferred in the direct stage, to reach the desired cooling temperatures. Traditionally, evaporative cooler pads consist of excelsior aspen wood fiber inside a containment net, but more modern materials, such as some plastics and melamine paper, are entering use as cooler-pad media. Modern rigid media, commonly 8" or 12" thick, adds more moisture, and thus cools air more than typically much thinner aspen media. In arid and semi-arid climates, the scarcity of water makes water consumption a concern in cooling system design. From the installed water meters, L , gal of water were consumed during for the two passive cooling towers at the Zion National Park visitors' center. Allowing direct solar exposure to the media pads increases the evaporation rate. Sunlight may, however, degrade some media, in addition to heating up other elements of the evaporative cooling design. Therefore, shading is advisable in most applications. Apart from fans used in mechanical evaporative cooling, pumps are the only other piece of mechanical equipment required for the evaporative cooling process in both mechanical and passive applications. Pumps can be used for either recirculating the water to the wet media pad or providing water at very high pressure to a mister system for a passive cooling tower. Pump specifications will vary depending on evaporation rates and media pad area. Otherwise, pressure develops and the fan or blower in the system is unable to push much air through the media and into the air-conditioned area. The evaporative system cannot function without exhausting the continuous supply of air from the air-conditioned area to the outside. By optimizing the placement of the cooled-air inlet, along with the layout of the house passages, related doors, and room windows, the system can be used most effectively to direct the cooled air to the required areas. A well-designed layout can effectively scavenge and expel the hot air from desired areas without the need for an above-ceiling ducted venting system. Continuous airflow is essential, so the exhaust windows or vents must not restrict the volume and passage of air being introduced by the evaporative cooling machine. One must also be mindful of the outside wind direction, as, for example, a strong hot southerly wind will slow or restrict the exhausted air from a south-facing window. It is always best to have the downwind windows open, while the upwind windows are closed. Typically, residential and industrial evaporative coolers use direct evaporation, and can be described as an enclosed metal or plastic box with vented sides. Air is moved by a centrifugal fan or blower usually driven by an electric motor with pulleys known as "sheaves" in HVAC terminology, or a direct-driven axial fan , and a water pump is used to wet the evaporative cooling pads. The cooling units can be mounted on the roof down draft, or downflow or exterior walls or windows side draft, or horizontal flow of buildings. To cool, the fan draws ambient air through vents on the unit's sides and through the damp pads. Heat in the air evaporates water from the pads which are constantly re-dampened to continue the cooling process. Then cooled, moist air is delivered into the building via a vent in the roof or wall. Because the cooling air originates outside the building, one or more large vents must exist to allow air to move from inside to outside. Air should only be allowed to pass once through the system, or the cooling effect will decrease. This is due to the air reaching the saturation point. Often 15 or so air changes per hour ACHs occur in spaces served by evaporative coolers, a relatively high rate of air exchange. Cooling towers are structures for cooling water or other heat transfer media to near-ambient wet-bulb temperature. Wet cooling towers operate on the evaporative cooling principle, but are optimized to cool the water rather than the air. Cooling towers can often be found on large buildings or on industrial sites. They transfer heat to the environment from chillers, industrial processes, or the Rankine power cycle , for example. Misting systems work by forcing water via a high pressure pump and tubing through a brass and stainless steel mist nozzle that has an orifice of about 5 micrometres , thereby producing a micro-fine mist. The water droplets that create the mist are so small that they instantly flash-evaporate. Misting is used for applications such as flowerbeds, pets, livestock, kennels, insect control, odor control, zoos, veterinary clinics, cooling of produce, and greenhouses. A misting fan is similar to a humidifier. A fan blows a fine mist of water into the air. If the air is not too humid, the water evaporates, absorbing heat from the air, allowing the misting fan to also work as an air cooler. A misting fan may be used outdoors, especially in a dry climate. It may also be used indoors. Small portable battery-powered misting fans, consisting of an electric fan and a hand-operated water spray pump, are sold as novelty items. Their effectiveness in everyday use is unclear. Understanding evaporative cooling performance requires an understanding of psychrometrics. Evaporative cooling performance is variable due to changes in external temperature and humidity level. It is simple to predict cooler performance from standard weather report information. Because weather reports usually contain the dewpoint and relative humidity , but not the wet-bulb temperature, a psychrometric chart or a simple computer program must be used to compute the wet bulb temperature. Once the wet bulb temperature and the dry bulb temperature are identified, the cooling performance or leaving air temperature of the cooler may be determined. The direct saturation efficiency can be determined as follows: [29]. The CELdek media is more often used in large commercial and industrial installations. Cooling examples extracted from the June 25, University of Idaho publication, " Homewise ". Because evaporative coolers perform best in dry conditions, they are widely used and most effective in arid, desert regions such as the southwestern USA , northern Mexico , and Rajasthan. This gives a dew point of Comparison of evaporative cooling to refrigeration -based air conditioning :. From Wikipedia, the free encyclopedia. This article is about air conditioning. For similar concept in atomic physics, see Evaporative cooling atomic physics. See also: Passive cooling. Device that cools air through the evaporation of water. Main article: Cooling tower. This section possibly contains original research. Please improve it by verifying the claims made and adding inline citations. Statements consisting only of original research should be removed. August Learn how and when to remove this template message. Iranian cities: formation and development. The Workshop Book. Taunton Press. Stanford University Graduate School of Business. Passive and Low-Energy Cooling of Buildings. Van Nostrand Reinhold. Retrieved 22 November Bibcode : Sci Environmental Research Laboratory, University of Arizona. The green studio handbook: environmental strategies for schematic design. Architectural Press. Mechanical and Electrical Equipment. Department of Energy. Retrieved 12 December Applied Energy. Journal of Energy and Emission Control Technologies. Wyss Institute. Retrieved Retrieved 9 June December Retrieved 12 September Saturn Resource Management. Archived from the original PDF on 10 October Home appliances. Appliance plug Appliance recycling. Heating, ventilation, and air conditioning. Architectural acoustics Architectural engineering Architectural technologist Building services engineering Building information modeling BIM Deep energy retrofit Duct leakage testing Environmental engineering Hydronic balancing Kitchen exhaust cleaning Mechanical engineering Mechanical, electrical, and plumbing Mold growth, assessment, and remediation Refrigerant reclamation Testing, adjusting, balancing. Categories : Psychrometrics Cooling technology Heating, ventilation, and air conditioning Evaporators. Hidden categories: Webarchive template wayback links Articles with short description Short description matches Wikidata All articles with unsourced statements Articles with unsourced statements from February Articles with unsourced statements from May Wikipedia articles needing clarification from May Articles that may contain original research from August All articles that may contain original research Articles with unsourced statements from July Namespaces Article Talk. Views Read Edit View history. Help Learn to edit Community portal Recent changes Upload file. Download as PDF Printable version. Wikimedia Commons. Join Stack Overflow to learn, share knowledge, and build your career. Connect and share knowledge within a single location that is structured and easy to search. Someone told me about swamp diagrams explaning that they were useful to predict code quality by measuring the rate of incoming defects and outgoing fixes on a given product. Unfortunately, I am unable to find additional information on those diagrams and I am wondering if it is a jargon term specific to one company. Now what is interesting about a swamp diagram is the repartition ratio aspect , the way you can easily see groups "swamps" of data against two axis. You can visualize the nature of the fixing: is that fixing process efficient when a lot of bugs are found or not? And that can tell you a lot on the nature of the defects found that 'lot' or swamp can refers to many very easy bugs due to a stupid typo repeated in lots of file and easily corrected, but that other lot quite as important but fixed really slowly may indicate a more structural problem affecting perhaps the architectural choices of your application: you want to focus on that swamp. Finally, no, it is not an internal term from some company, just an old term referring to old diagrams of As David Segonds says in a comment, the modern name would be a " binomial trendline " although the ratio aspect tends to get a bit lost in that kind of diagram. You can see an example in this Graph of voter turnout by age. Another modern example of a swamp diagram would be this diagram showing each county as an ellipse, with the size of the ellipse proportional to the population of the county more precisely, the voter turnout in the two elections. Learn more. What is a Swamp Diagram? Ask Question. Asked 12 years, 4 months ago. Active 5 years, 11 months ago. Viewed times. Can you explain what a swamp diagram is? Improve this question. David Segonds David Segonds Add a comment. Active Oldest Votes. If your two axes are: the rate of incoming defects and the rate of outgoing fixes You can visualize the nature of the fixing: is that fixing process efficient when a lot of bugs are found or not? And that can tell you a lot on the nature of the defects found that 'lot' or swamp can refers to many very easy bugs due to a stupid typo repeated in lots of file and easily corrected, but that other lot quite as important but fixed really slowly may indicate a more structural problem affecting perhaps the architectural choices of your application: you want to focus on that swamp Finally, no, it is not an internal term from some company, just an old term referring to old diagrams of Improve this answer. VonC VonC 1. Hum, this is certainly interesting. I am going to try to apply this to the data we collected on our project in the last few weeks. I can also combine this with the severity of the defects. Thank you for your research. Sign up or log in Sign up using Google. Sign up using Facebook. Sign up using Email and Password. Post as a guest Name. Email Required, but never shown. The Overflow Blog. Podcast How do digital nomads pay their taxes? Featured on Meta. Opt-in alpha test for a new Stacks editor. Visual design changes to the review queues. Survey questions for outdated answers. Introducing Outdated Answers project. Linked Related 0. Hot Network Questions. Question feed. Stack Overflow works best with JavaScript enabled. Wiring a window- or wall-mounted swamp cooler is usually as simple as plugging the cooler into an outlet and switching it on. Normally there is no heavy duty supply harness to be run or thermostat connections to be made, as are required by air conditioning systems. However, some swamp coolers are located on roof-mounted platforms, and these require the installation of a multi-conductor cable between the cooler and a switch positioned conveniently in the home. Wiring the switch is a straightforward and uncomplicated project. Determine which size multi-conductor cable you will need by checking whether the swamp cooler's motor is or single- or twin-speed. The single-speed motor will require four-conductor cable to function, and the twin-speed motor will require five-conductor cable. Buy sufficient cable that runs need not be stretched tight through the roof void or crimped around corners. Route a gauge volt hot wire, usually color-coded black or red, to the location of the switch there is typically no need for a ground or neutral wire to the switch. The reverse of the switch will have four terminals, typically marked "L1," "1," "2" and "C. Follow the instructions provided by both the swamp cooler and switch manufacturers to connect the individual wires of the multi-conductor cable to their appropriate switch terminals. Typically a red wire operates the motor's low speed and is connected to terminal "1," a black wire operates the motor's high speed and is connected to terminal "C" and an orange wire operates the pump and is connected to terminal "2. Use cable clips or plastic zip ties to retain the multi-conductor wire where it will not present a trip hazard. John Cagney Nash began composing press releases and event reviews for British nightclubs in His material was first published in the "Eastern Daily Press. In he earned an OxBridge doctorate in philosophy and immediately emigrated to America. Step 1 Determine which size multi-conductor cable you will need by checking whether the swamp cooler's motor is or single- or twin-speed. Step 2 Route a gauge volt hot wire, usually color-coded black or red, to the location of the switch there is typically no need for a ground or neutral wire to the switch. Step 3 Follow the instructions provided by both the swamp cooler and switch manufacturers to connect the individual wires of the multi-conductor cable to their appropriate switch terminals. A six-position rotary switch has a position for off, low-speed fan, high-speed fan, low-speed fan with pump, high-speed fan with pump and pump only. If your swamp cooler only has one fan speed, wire the fan to terminal "1. Electrical toolkit Multi-conductor cable Swamp cooler six-position switch volt supply. Ensure the volt power is switched off at the circuit breaker before handling the hot wire. Welcome to our Do-It-Yourselfer swamp cooler wiring article. If you arrived here directly from the internet, you may want to visit our other swamp cooler information and swamp cooler installation pages first, and then return here. Swamp Cooler Installation: Ductwork Swamp Cooler main page: All about the "Swamp" Swamp Cooler Maintenance Swamp Cooler Roof Installation The best time to rough in your swamp cooler wiring and water line for your new cooler is after the holes are cut through the roof and ceiling, but before the ductwork is installed. The attic will be relatively cool because of the natural ventilation of the heat exiting the roof. If the swamp cooler wiring can be done now without interfering with the ductwork installation, you will be a much happier Do-It-Yourselfer. A degree attic with blown in insulation is not a pleasant place to be crawling around, pulling wires and water lines. The diagram to the left is a very typical rambler style one level home with a basement mechanical room. Your home may be configured differently, but you should still be able to adapt the basic wiring and water line configuration into your home. Often the best route for your swamp cooler wiring and water line between mechanical room and the attic is the flue chase. This is a very popular location for the wiring and water line, because the chase is accessible from both the basement or main level mech. Once you have roughed-in the wiring and water line to the attic, simply pull across them across the attic space to your roof jack next to the cooler. Make sure that the water line is not touching the flue. A plastic water line may melt and leak, and a copper one will rot away if touching a galvanized sheet metal flue. Do NOT install a coupling in the attic space. Couplings are prone to leaking and will likely destroy your ceiling without notice. At the swamp cooler, the water hook-up is usually located on an exterior corner of the cooler. This is a direct connection to the float assembly inside the cooler. Pull the water line out the top of the roof jack and route to this location. Ensure that there is upward slope to the float location. A low spot could hold water and freeze during the winter, causing a leak at start-up time in the spring. The other end ties into the cold water supply line in the mechanical room. Self-piercing saddle valves are available for this purpose. But, saddle valves are undependable. The swamp cooler wiring. Determine first the best location for the switch. This can be tricky, as the route must communicate with unfinished space to the power source, and also communicate with the attic. Once again, if it is practical, placing the switch on the outide of the flue chase can be a good option. Make sure that the wiring does not touch the flue. The heat from a flue can melt the outer coatings of the wire, and is a fire hazard. On the cooler end, during rough-in, leave plenty of extra length. The power junction box is up high inside the cooler cabinet. Residential volt wiring is fairly uncomplicated and easy to understand, however some folks are not comfortable working on any wiring. If this is you, contact a professional electrician to complete this part of the installation. Refer to above diagram The green ground wires never carry electricity. They are a safety "path to ground" to reduce the chances of shock and injury. The white wire is the common. This wire is dead and carries no electricity until the switch is turned

1996 chevrolet s10 pick up 2 2 engine diagram
73 powerstroke pulley diagram
2000 toyota 4runner exhaust system diagram

to one of the operational postions. Then the line is live and completes the circuit back to the power source. Vent only hi or lo is used for circulation of outside air through the home when cooling is not needed. The pump only setting is used before each use of the cooler. Turn the pump on for 10 minutes to thoroughly wet the pads before use. The cool settings hi or lo is full operation with pump wetting the pads and blower distributing cooled air into the residence. The switch pictured here is the most common switch available for a conventional downdraft or sidedraft swamp cooler installation. This is a two speed switch with fan only option and pump only option. The swamp cooler wiring pictured and explained here is unnecessary if you are installing a window mount cooler or a sidedraft style window cooler. Both of these simply plug into the wall, and utilize the provided switch on the front of the discharge grille. Site Build It! Site Navigation. Copyright - perfect-home-hvac-design.