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Tortoise Care

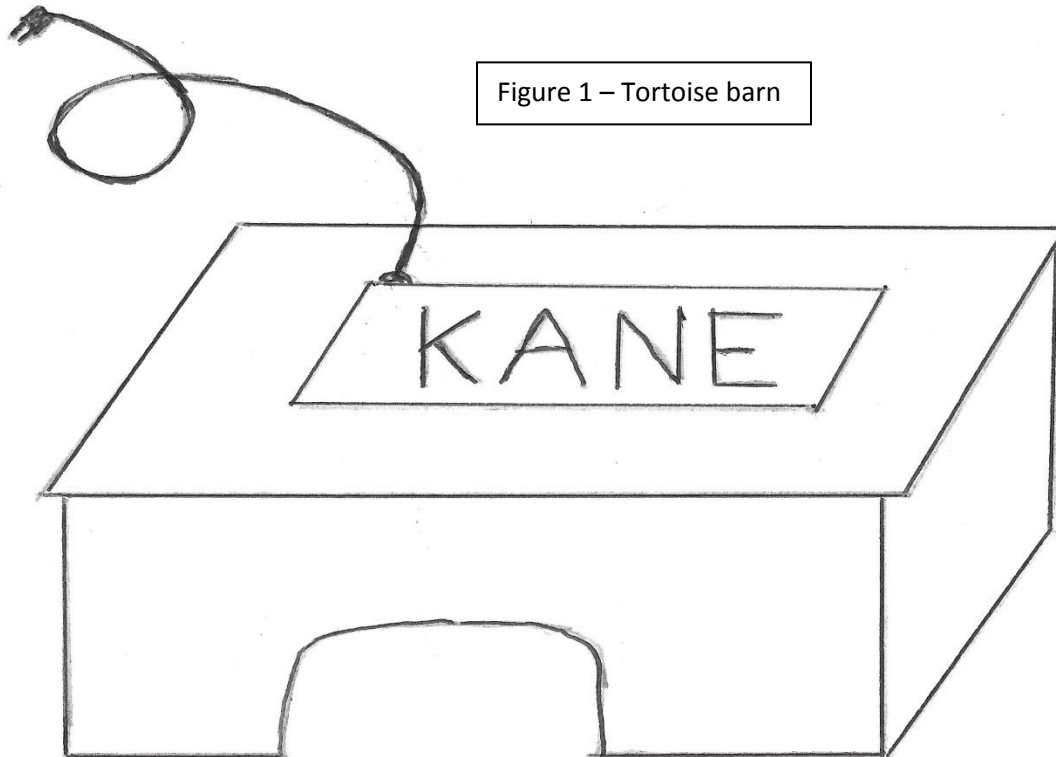
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Taxonomy - The true tortoises are all members of the family Testudinidae, which encompasses 12 genera with 40 living species. Common temperate species include desert tortoises (*Gopherus agassizii*), gopher tortoises (*G. polyphemus*), Texas tortoises (*Gopherus berlandieri*), Hermann's tortoises (*Testudo hermanni*), Russian tortoises (*T. horsfieldi*), and Greek tortoises (*T. graeca*). Common tropical species include red-footed tortoises (*Geochelone carbonaria*), yellow-footed tortoises (*G. denticulata*), spurred or Sulcata tortoises (*G. sulcata*), leopard tortoises (*G. pardalis*), radiated tortoises (*G. radiata*) and hinged, or hinged-backed tortoises (*Kinixys* spp.). Any review of tortoise care for such a diverse family is overly simplistic, and fraught with multiple exceptions, none the less here are some general guidelines for keeping tortoises healthy in San Diego, CA.

Outdoor housing - Whenever possible, tortoises should be kept outdoors, even if only for a small portion of the year. This allows them space to exercise, graze, and bask in the sun, which is important for vitamin D synthesis, which helps with calcium absorption. Well acclimated adult tropical tortoises can be housed outdoors when morning temperatures are above 18° C (65° F) and midday temperatures exceed 24° C (75° F). Bring them in at night when temperatures are below 18° C (65° F) or provide a heated outdoor enclosure (see tortoise barn below). Adult temperate species tolerated temperatures 3° C (5° F) less than those listed for tropical species provided it warms up to 24° C (75° F) during the day. For small juveniles, temperatures should always be above 24° C (75° F) (see neonatal care later).

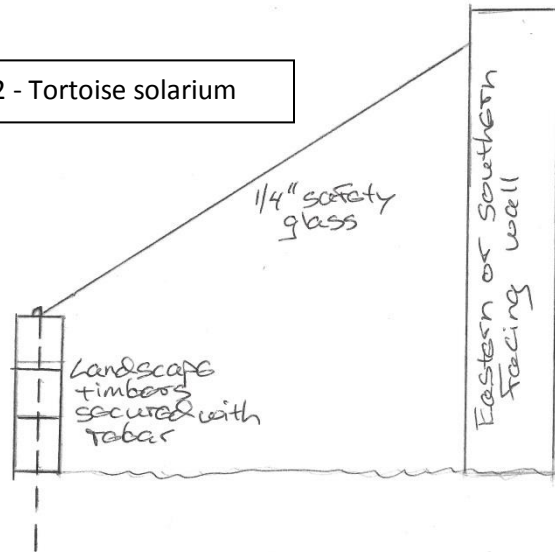
Tethering a tortoise by a leg or through a hole in the shell is not an acceptable and is potentially harmful. Leg tethers can cut into flesh, result in severe infection, cut off blood supply and result in loss of the limb or even death. Drilling a hole through the shell should be considered inhumane. When planning outdoor enclosures, several factors should be considered. Desert species can tolerate higher temperatures and drier enclosures than tropical rainforest species. Outdoor enclosures can be modified to suit the needs of species. For tropical forest forms, such as *Geochelone carbonaria*, *G. denticulata*, *Manouria emys*, *Kinixys homeana*, *K. erosa*, *K. belliana*, and *Indotestudo* spp., densely planted enclosures are ideal. For grassland, or desert species, such as *Gopherus* and *Testudo* spp., *Geochelone sulcata*, and *G. pardalis*, enclosures can be more sparsely planted with shrubs and grasses. In either type of enclosure, shelters should be provided for retreat from the elements as well as shade. Desert and gopher tortoises and Sulcatas will sometimes dig burrows facing south or west, make sure the burrows can't flood in the winter or the tortoise may drown. Tortoises dig burrows down but not back to the surface so don't worry about them escaping. Burrows are a necessity in very hot areas to prevent overheating. For more information on burrow construction see Arizona's Fish & Game site, http://www.azgfd.gov/w_c/tortoise/burrow.shtml.

Tortoise Barn - In San Diego coastally it is often too cold for tortoises without supplemental heat, and, even inland, supplemental heat is advisable at night. All tortoises benefit from heated barns (see figure 1) fashioned from $\frac{3}{4}$ inch AC plywood with a hinged, sloped, insulated, slightly overhanging and heated roof. The corners are secured with inner L braces and caulked, the floor is open to the dirt to boost humidity and ease cleaning. Hinging the roof also makes it easier to clean; waterproofing the plywood will extend its lifespan. A 12 x 36 inch Kane pig blanket (Kane MKG, Inc., Des Moines, IA) suspended loosely from the solid inner roof insulation warms the barn. A dusk to dawn timer will keep heat on at night and off on warmer days or it can be run continuously and the doorway covered with slit plastic on colder days. The doorway should be just large enough for tortoises to fit through.



Another way to boost heat is to make a solarium with $\frac{1}{4}$ inch safety glass secured on one side by quarter round on top of two to three stacked 4 x 4 inch landscape timbers, drilled through and secured with rebar running through them and into the ground, with the glass leaning up against an eastern or southern exposure wall at 45° angle and open at both ends. This allows the tortoises to thermoregulate on their own, see figure 2.

Figure 2 - Tortoise solarium



Outdoor enclosures should have secure perimeters. Tortoises generally pace at the perimeters and constantly try to get through perimeters they can see through. Therefore, solid barriers, such as wooden fencing or smooth concrete, at tortoise eye level are preferable to open fencing. Open fencing should be small enough that tortoises cannot entrap a leg or neck in it. Chicken wire, for instance, can entrap and cut tortoise legs and is thus not advisable. Fencing should be staked down to the ground and lean inward slightly to discourage climbing.

Outdoor hazards - Predators, especially dogs, are fond of chewing on tortoises and can wreak havoc in no time at all. Small chelonians can be devoured without a trace. Be careful that a neighbor's dog that smells, sees and hears your tortoise doesn't dig under a fence to get it. Raccoons and opossums enter yards at night to prey on tortoises. In the southern United States fire ants (*Solenopsis* spp.) can attack and kill small tortoises. Never trust a dog alone with a small tortoise.

Another potential threat, especially in residential areas, is pesticide spraying. Do not spray tortoise enclosures with pesticides. Instruct owners to have their neighbors inform them when they apply pesticides so that their tortoises can be removed to a safer area.

In smaller enclosures tortoises will consume all the vegetation growing in their enclosure. Toxic plants are rarely a concern (oleanders and rhododendrons are exceptions) even though extensively discussed. Most grasses, clover, perennial legumes, iceplants, and dandelions are excellent free forage. Tortoises will also eat anything that falls into their enclosure. Enclosures should be regularly examined for scraps of metal, staples, wires, nails, tacks, twist ties, or any other type of metal, pieces of plastic or rubber, plastic bags, twine, or any other trash that blows in. Tortoises will also consume small rocks, gravel, decomposed granite, pumice, pebbles (especially if they don't have enough calcium in their diet) and sand. Never house tortoises on small rocks, gravel, pebbles or sand or life threatening intestinal impactions will occur.

Indoor Housing – In colder areas of the country indoor housing is usually mandatory for a good portion of the year. Tortoises require more space than most reptiles. The New York Turtle and Tortoise Society recommends that the combined shell size of all tortoises present should not exceed a quarter of the floor surface area available to the tortoises. Aquariums, plastic or metal livestock troughs, concrete mixing containers, or plastic sweater boxes can be used for small tortoises. Cages can be constructed for larger tortoises with ½ -to ¾-inch plywood on the bottom and 2 by 12 inch planks stacked on one another or plywood along the sides. The inner cage surfaces should be caulked

and sealed with an undercoat of water sealant and two to three coats of polyurethane, or one can use melamine. Melamine tends to warp if it gets wet. Sealing exposed wood surfaces facilitates cleaning and disinfecting. Allow the cage to air out thoroughly (usually about a week) before placing any tortoises in it. To prevent chilling, the cage bottom should not be in direct contact with cold concrete; a gap of several inches is advisable, such as on resting on 2 x 4's. An alternative to building a cage is to convert a garage or unfinished room into a tortoise pen. Ambient indoor temperature should be 24 to 32° C (75 to 90° F), depending on the species. Rooms can be heated with thermostatically controlled space heaters. A thermogradient should be provided with basking lights and/or heating pads.

Substrates - Juveniles are often maintained indoors on alfalfa pellets and as they graduate to larger cages, a mixture of medium to large conifer bark nuggets and peat moss or coconut coir. Acceptable alternative substrates include newspaper, indoor-outdoor carpeting (be sure to avoid frayed edges), or corrugated cardboard. Remove fecal material from the enclosure several times per week and replace the substrate several times per year. For very large enclosures and large species, smooth cement, clean soil (baseball infield soil or soil with a high clay content), can be used, provided the room stays warm. Avoid sand, gravel, cat litter, and crushed corncob or walnut shells. Many tortoises are reclusive animals. As with outdoor enclosures, a tortoise barn or hide box should be provided.

Water - Water should be regularly available for indoor and outdoor tortoises. Shallow plastic plant saucers work well for tortoises. Make sure the water is no more than chin deep or the tortoise may accidentally overturn and drown. Tortoises often defecate in their water; thus, water bowls should be changed daily, every other day, or whenever dirty. Tortoises outdoors will also drink from standing water. An alternative to water bowls is to soak the tortoises in chin-deep water several times per week.

Feeding - Diets for captive tortoises are an area of considerable uncertainty, variability and continues to evolve. Wild tortoises often utilize forage of a relatively low nutritional value. In captivity, diets tend to have too much or too little protein, too much carbohydrates, and not enough fiber or calcium, which is unhealthy. Commercial tortoise diets, such as Mazuri's Tortoise Diet and Tortoise LS High Fiber and ZooMed's Natural Grassland Tortoise Food and Natural Forest Tortoise Food, and hays tend to have better calcium levels and nutrient profiles similar to what desert tortoises naturally consume. Backyard grasses or grass hays (Bermuda, Timothy, Kentucky bluegrass, Buffalo, Brome, Tall fescue, Orchard grass but not Alfalfa hay, which is too high in protein) are also very good. Getting tortoises to eat hay and commercial foods can be tough. Chopping the hay with scissors, or a food processor, and sprinkling or spraying the hay with water, to moisten it, helps, or it can be soaked in water for several minutes. Soaking too long will leach out nutrients. Mixing the normal food in or under the hay also helps. Mazuri pellets can be soaked in water until just soft and mixed into the salad. Be patient and persistent and tortoises will switch over to hay and commercial pellets. Sulcatas grow so large you almost have to get them eating hay. Back yard weeds (esp. dandelions, clover, burclovers, purslane, spurges, crabgrass, cheeseweed, creeping woodsorrel and others), spineless prickly pear cactus pads & fruits (*Opuntia ficus-indica*), dark leafy greens (collards, mustards, turnip tops, bok choy, kale, spinach, cabbage, endive), flowers (roses, nasturtiums, hibiscus, carnations, nasturtiums, geraniums, primroses, iceplant and cactus flowers), leaves (Mulberry, grape, hibiscus, squash) can also be fed. One can also plant plants naturally eaten by desert tortoises, see the Arizona Fish & Game site (http://www.azgfd.gov/w_c/documents/NativePlantsforDesertTortoises_2008.pdf) and California Turtle & Tortoise Society site (<http://www.tortoise.org/general/wildplan.html>) for good ideas.

Be aware of several widespread misconceptions. Members of the cabbage family (cabbage, kale, mustard greens) can cause thyroid problems (goiter) if fed exclusively and long term, but are harmless in moderation as part of a balanced diet. Let me repeat that, cabbage, kale, and mustard greens are OK as part of a balanced diet. Spinach,

beets, Swiss chard and rhubarb have oxalates in them but nowhere near as much as plants consumed regularly by wild desert tortoises. Oxalates can bind with calcium in the intestinal tract and decrease calcium absorption and theoretically contribute to kidney damage, but this hasn't been borne out by scientific studies. In fact, one scientific study concluded that oxalates in desert tortoises were an incidental finding or non-pathogenic. In moderation spinach, beets and Swiss chard should not cause any problems. Most tortoises won't eat Swiss chard however. Rhubarb should not be fed at all.

Fruits - Fruits, in general, are mineral poor yet high in sugars and can disrupt the normal gut flora and lead to fatty livers. Fruits are tasty enough that tortoises will consume them preferentially over more nutritious foods. Therefore limit fruits to a miniscule portion of the diet, more of an occasional treat than a staple, or don't feed them at all. Apples, apricots, bananas, dates, figs, grapes, kiwis, melons, mangos, peaches, papayas, pears, plums, prunes, raisins, star fruit, strawberries, tomatoes and raspberries are all fine occasionally. Do not over do it! Red and yellow foot tortoises are more frugivorous than other tortoises and should be offered more fruit, but no more than 20% of the entire ration.

Put the salad on a flat board, piece of newspaper, or paper plate, or use plastic or metal plates or trays. Disposable feeding trays cut down on cleaning. Never feed tortoises over sand or they will accidentally ingest it. Feed as much variety as possible! The majority of the diet should be commercial tortoise chows and hay. Adults should be fed a minimum of three times per week and hatchlings daily. Every feeding, for juveniles, lightly dust food with calcium carbonate, lactate, citrate, or gluconate. Adults only need calcium several times per month. Twice a month lightly dust food with multivitamins (if vitamin-fortified foods tortoise foods are not being consumed). If the tortoises are exposed to unfiltered sunlight or indoor ultraviolet lights, vitamin D supplements are not needed, nor desired.

Reproduction - Female tortoises must be in prime condition prior to egg production. This includes a well-balanced diet with adequate calcium. Small tortoises can be palpated in the inguinal fossa for eggs, but this is much more difficult in larger tortoises. A large African female tortoise can cause excruciating pain to the forefinger foolhardy enough to be caught between her shell and rear leg. Eggs show up well on x-rays. Gravid females feel heavier than normal and tend to be more active, often pacing in the enclosure. For nesting, areas are often selected that get the most sun or late afternoon sun. If the keeper is not present during egg laying, the nest can be easily missed. A definite sign that a female has been digging is dirt packed on her hind feet and rear margins of shell. Some females may excavate several nests before actually laying eggs. Indoors one must provide a nesting substrate at least as deep as the female's carapace length.

Neonatal care - Once the neonate has pipped the eggshell with its caruncle, or eggtooth, it will emerge from the shell within 1 to 4 days. During this time, the neonate's shell begins to unfold, facilitating yolk absorption. As the neonate's shell straightens and the tortoise begins to move, the eggshell breaks further. Once out of the egg, the neonate may still have considerable yolk sac. The hatchling should be transferred to a container, such as a plastic shoe or sweater box, with clean moist paper towels. The yolk sac will be slowly absorbed over the next few days. Once the yolk sac is fully absorbed and the umbilicus sealed, the hatchling can be transferred to a cage with previously mentioned substrates. Hatchlings usually begin feeding within 1 to 14 days of leaving the egg. Hatchlings are prone to dehydration; therefore shallow water bowls should constantly be available. Make sure the water bowl is shallow or the hatchling may overturn and drown. Plastic plant saucers work admirably for water bowls. An alternative is to soak neonates in shallow water three times a week. Ultraviolet lights should be provided for 12 hours per day for all tortoises not housed outdoors. A thermal gradient should be provided. Ambient temperature should not get colder than 24°C (75°F) at night and gradually warm to 30°C (85°F) during the day. Temperatures cooler than this are devastating to hatchling tortoises and can quickly lead to respiratory problems, anorexia, and death. Temperate

young tortoises should be given a carefully controlled, shorter hibernation period or not hibernated at all for the first several years. Hatchlings can be fed the previously described ration daily, finely chopped in a food processor. Hatchlings should develop a firm shell well within the first year if they are getting enough calcium. Hatchlings should get calcium with every feeding. It is common for a clutch of siblings to have different growth rates. Smaller timid individuals may eventually need to be separated to ensure adequate nutrition.

Thanks to Don Boyer for helping write earlier drafts of this care sheet.