Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) **ISSN:2455-0221(P), 2394-2606(O)**

ANALYSIS OF THERMAL FACILITIES ACCORDING TO ECOLOGICAL ARCHITECTURE DESIGN CRITERIA
(The Example of Bingöl and its Nearby Areas)

Nurtekin ÖZEN[1], KÜRÜM VAROLGÜNEŞ[2]

[1]Researcher Fatma ,[2]Dicle University, Faculty of Architecture, 21050, DİYARBAKIR, TURKEY
Bingöl University, Faculty of Architecture and Engineering, 12000, BİNGÖL, TURKEY

ABSTRACT

During the last years, the market share of thermal tourism started to increase considerably worldwide. Along with this, during the rapidly developing facility construction process; the constructions of unplanned buildings that lack infrastructure based on economic concerns only cause permanent damage to the environment. In order to decrease these negative effects, designers have to take into account ecological design criteria during the macro and micro scale design process. In this study, we aimed to demonstrate how facilities with ecological features should be built and to provide a guide for the construction of new facilities. Designs that offer ecological solutions will allow a healthier development of thermal tourism and ensure that thermal facilities gain a distinct identity among touristic buildings. For this, first, local facilities that are in harmony with the natural environment have to be analyzed in order to understand how structures that are compatible with nature are being built. Within this context, facilities in the Eastern Anatolian Region of Turkey, the ecological features of which have been protected, were analyzed, the problems were identified and relevant solutions were proposed.

Keywords: thermal tourism facilities, hot springs, ecology, ecological architecture, Turkey, Bingöl

INTRODUCTION

In terms of its thermal resources Turkey ranks first in Europe and seventh in the world. The thermal waters here are superior with respect to their flow rate, temperature, and chemical properties compared to most thermal waters in Europe. The number of hot water resources is more than 1,500. These are present almost in every region, from Trace to Eastern Anatolia (Figure 1). After this potential was realized, the facility construction process grew rapidly. Proper management of this process and the development of ecological solutions in facility designs will allow healthier development of thermal tourism and result in the least damage to the environment. The hallmark and success of an architectural product depends on properly identifying the surrounding environmental conditions (topography, climate, natural and artificial environmental data, socio-cultural structure, laws and regulations) and transferring these to the process of planning accurately and in a sound manner [1]. The eco-thermal facility concept is becoming increasingly widespread in many parts of the world. In our country, which is yet in the beginning of the facility establishment process, adopting ecological architecture criteria will increase our share in this industry without consuming the future of our next generations. Sustainability means continuity, development, and adaptation to innovation [2]. Based on these,

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

the main goal of the study is to present the ecological building criteria of thermal tourism facilities starting from the designing phase. The sub-goals that will support this can be listed as follows:

- Creating awareness in order to provide the accurate assessment of the geothermal resource potential in Turkey,
- Drawing attention to protection of the environment along with human health,
- Analyzing Bingöl and its nearby areas in terms of their thermal tourism potential and creating a guide for how ecological thermal facility design can be realized in this region,
- Demonstrating the benefits that will be brought to the country's economy by making use of resources in rural areas with intact ecological features.

The study area was selected as Bingöl and its nearby areas, which are not well explored yet and maintain their ecological characteristics. In addition to its thermal water resources, this is also a suitable rehabilitation area for human health, thanks to its rich vegetation, natural beauties, and micro climate. The area's rehabilitation value is increased since it is away from the city center and noise and air pollution are absent.

According to the investigations carried out in these thermal spring regions, it was observed that the designs of the facilities consisted of a cure park, cure units, and an accommodation unit center. The ecological thermal facility development plan was prepared for all the three spring facilities.

Figure 1. Map of Geothermal Resources in Turkey

Figure 2. The location of Bingöl Province in the Turkish Map

Materials and Method

Personal observations, project inspections, and group interviews were carried out in Kös, Golan, and Bağin thermal springs, which are located in the Eastern Anatolia region of Turkey within the boundaries of Karakoçan and Tunceli (Figure 2). A survey was applied to facility users. The survey method was selected because collecting information by means of directly contacting the users was an appropriate method for the context of the research. It was aimed to obtain data on the relationship between the user, building, and environment. The questions in the survey were prepared according to subjects including personal information of users, awareness of users about utilizing a thermal facility, awareness of users about ecological environment, user satisfaction and demands, and the characteristics of the thermal facilities in the study area. Besides the survey and interviews, facility data were also obtained through observations. Pictures were taken, size measurements were carried out in the units, building surveys were made, and these were drawn with a computer program. In the survey method; the perceptions, satisfaction, expectations, and demands of the users were determined and the obtained data were interpreted with the aid of SPSS (Statistical Package for the Social Science) program. The survey study was carried out by personally interviewing 100 participants who

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

were randomly selected among facility users. The obtained data were evaluated in tables and graphs prepared using MS Word and Excel programs. The presence of any relationship between the questions was evaluated with the Chi Square Test. Using the received data, the thermal facilities around Bingöl and its nearby areas were analyzed according to ecological architecture design criteria and the success and failure of these facilities in terms of ecological compliance were identified. As a result, a guide was prepared for facilities that will be built in the future.

RESULTS AND DISCUSSION

Environmental awareness and energy efficiency in architecture have become a major concern for designers and the emphasis laid on research of environmentally-economically appropriate buildings has increased [3]. Ecological buildings with energy conservation allow the creation of spaces that provide a higher quality life thanks to their features. The survey was carried out with a total of 100 users -62 and 38 of who were male and female, respectively- in the actively used Kös, Bağin, and Golan thermal facilities that are located around Bingöl and its nearby areas. The survey consisted of three sections that contained 92 questions, which aimed to interpret the personal characteristics of the thermal facility users, their reason to prefer the thermal facility, and the facility's compliance with ecological architectural criteria.

1. The Demographic Characteristics of the Facility Users and their Interpretation

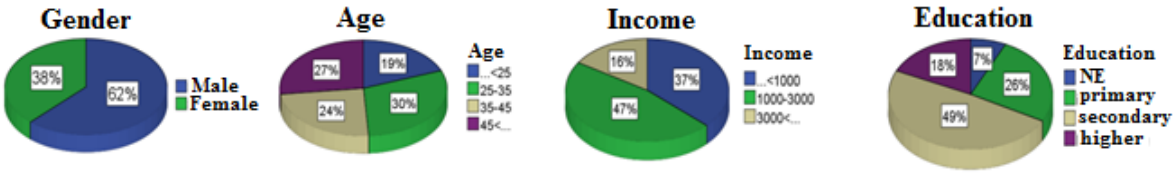


Figure 3. The demographic characteristics of Survey participants

The thermal facilities are facilities used mainly to get rid of intense stress, regain back health, rest, and acquire wellness. As can be seen from the survey analysis, this way of vacation, which is preferred especially in all the non-coastal regions of the country, appeals to all age groups, all budgets and all educational statuses. The reason for the higher number of male subjects in the study is that most of the women in the region's facilities refused to take the survey.

2. Data on the Thermal Facility Preference of Users and their Evaluation

Users were asked what the thermal facility meant for them, about their frequency of visiting the thermal facility, about the size of their visiting group, about the means of transport to the facility, about their point of arrival, about their reason for visiting the facility, about reasons for previous visits to touristic facilities, about the time of the year they prefer to visit the facility, and which other things did they benefit inside and outside of the facilities. This survey study was required because of the importance of user preferences and demands in the design of a thermal facility. User demands, the answers of the facility businesses to these, and the demands of the facility businesses are important elements that will influence the design of the facility.

Table 1 Analysis of the Survey Results

Where the facility users did came from?	From the county	From the province	From the region	From outside the region	From abroad
	25%	29%	29%	10%	7%
What is the facility visiting frequency of the users?	Once per week	Several times per week	Several times per month	Several times per year	
	16%	13%	35%	36%	
How many people are in	1-2	3-4	5-6	More than 6	

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

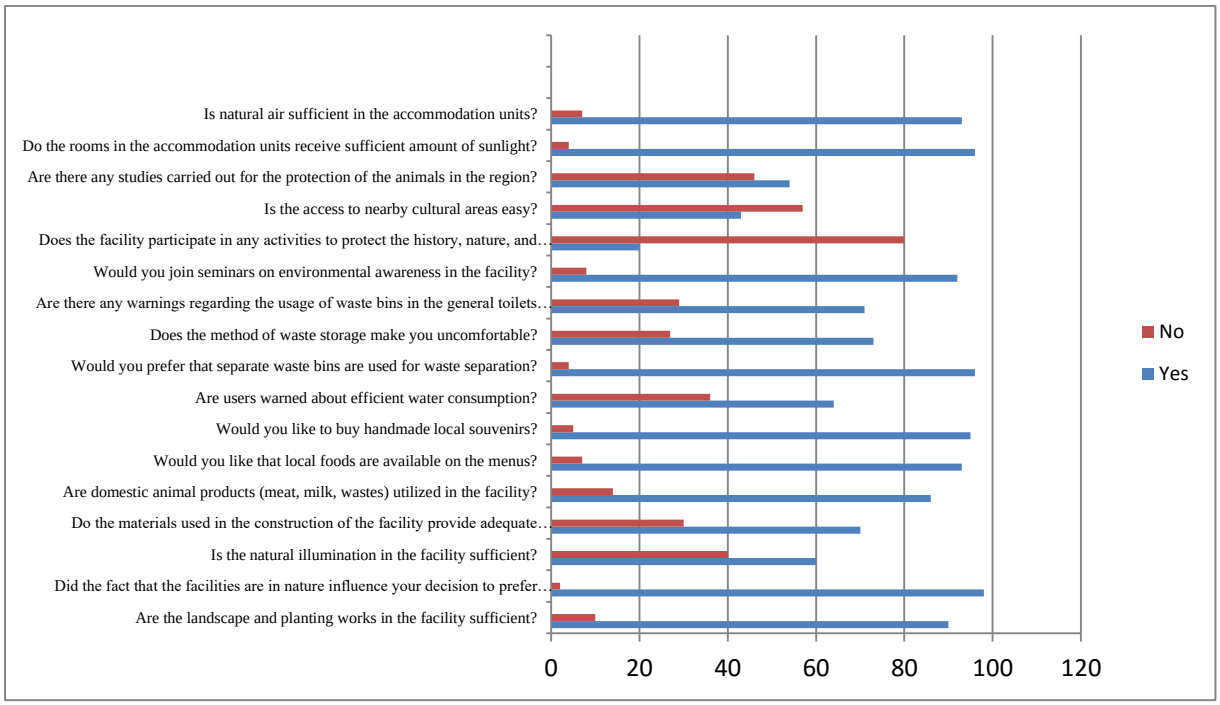
their visiting group, generally?	8%	32%	26%	34%	
How do users reach the facility?	Private car	Public transportation	Walking	Bicycle	
	74%	19%	5%	2%	
What time of the year do users prefer to visit the facility?	Summer	Winter	Spring	Every time of the year	
	33%	7%	14%	46%	
What do users think of when asked about a thermal facility?	It is a place beneficial for health	It is a relaxing place	It's climate is healing	It offers holiday opportunities during all seasons of the year	
	56%	24%	17%	3%	
What is the purpose of the users in visiting the thermal facility?	Being treated under the control of a physician	Being treated upon recommendation	Making a holiday	Benefiting from the fresh air and the warm water	
	14%	14%	9%	63%	
Reason for preferring the facility?	The thermal water	Cleanliness and hygiene	The facility's being in touch with nature		
	62%	13%	25%		
What things other than facility services do you benefit from?	Mountain walk	Observation of wildlife	Bicycle ride	Seeing historical structures	Observing natural beauties
	27%	23%	2%	4%	44%
How should be thermal facilities built?	Built according to the natural environment	Built according to the design	Built in harmony with the local architecture	With an architectural style that does not harm the environment's ecology	
	33%	3%	11%	53%	
What is the most important characteristic that distinguishes your facility from the others?	The structure of its water	The ecological environment of the facility	The harmony of the facility with the natural environment	Its holiday opportunities	The quality of its services
	37%	23%	12%	3%	25%

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

According to the survey results, the facilities in the study area are preferred by those who are from geographically near provinces. It can be also stated that generally users from abroad are originally locals. It was observed that users who come from abroad come once or several times per year, they stay for a long period of time, and generally prefer the summer months for facility use. The locals who live in the area visit the facilities frequently and us them for a short period of time. Using the facility during all the seasons of the year is mostly preferred by the local community and the users who come from nearby areas. The reason for the facilities not being preferred by those outside the region is because the region and its facilities are not well known. In order for the facilities to be able to be used every season, closed passages should be constructed from the accommodation units to the cure units. As can be seen from the survey evaluation results, most of the users demand that special ecological design criteria are determined for the springs and the thermal facilities and facility classifications are made according to these.

Table 2 Analysis of survey Results (Thermal Facility (Cure Units, Accommodation Units, and Nearby Areas) Results and their Evaluation)



3. Evaluation of the Facilities According to Ecological Architecture Design Criteria

After evaluating the first part of the survey and determining the leading factors of ecological design, we obtained our data for the design of the ecological thermal facility. The most important and third part of the ecological design consisted of examining design criteria on the area. In this part, the survey analysis results were supported with observations, building survey studies, interviews, and picture studies; then were evaluated under ecological design criteria headlines and the obtained data were used to reach a conclusion.

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

Table 3. Evaluation of the Facilities According to Ecological Architecture Design Criteria

Conservation of Natural Resources	In the facilities located in the study area; solar, geothermal, and bio energy are used as renewable energy sources. Studies are continuing for the use of geothermal energy in the Kös thermal spring. As a result of observations and studies carried out in the area, it was seen that there were very serious deficiencies regarding water reuse and waste recycling. It is very important that recycling conditions are provided in order for these facilities to acquire ecological characteristics and to provide the conservation of resources.
Conservation of Energy and Energy Efficiency	Conservation of energy is the most important subject of ecological architecture design criteria and has to be analyzed in detail. Because of this, conservation of energy and energy efficiency were reviewed under separate subheadings.
Harmony with the Topography	It is obvious that topographies contain ecological and spatial differences. Because of this, natural structural differences and differences in geographical data will make the architecture genuine and will naturally make it part of the area [4]. The terrain structures where the three facilities are located have similar characteristics. The land is inclined and is a valley with natural vegetation (oak forests). Facility units were positioned so that they are exposed to heat and wind, in harmony with the terrain. In addition, the facility units were positioned in the terrain in small groups and in this way, their energy costs were decreased. In Kös and Bin-Kap thermal springs, the units were positioned side by side in the valley floor (Figure 4). The terrain slope was taken into consideration, thus there was no need to carry out too much elevation. The stream in the facility's front was reclaimed by the Ilıcalar town municipality and protection from flood was tried to be provided for the facility. The Golan thermal facility cure units were designed in the lowest elevation level. The restaurant and the cafeteria sections were positioned in the upper elevation level of the cure units and thus were oriented towards the scenery (Figure 5). Positioning the cure units and the pool at the resource point of the spring and the continuous circulation of the water provides the natural cleaning of the water. However, the discharged water is not recycled. The accommodation units in the facility

Figure 4. The settlement of the accommodation units in the Bin-Kap thermal facility

Figure 5. Terrain settlement of Golan thermal facilities

Figure 6. The terrain settlement of accommodation units in the Golan thermal facilities

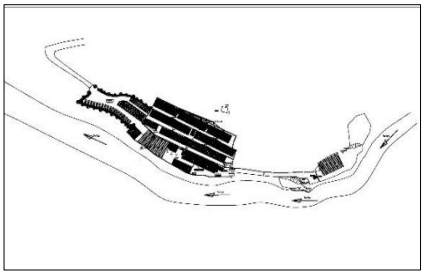


Figure 7. The Bagin thermal facility settlement plan

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

	were positioned side by side in the upper elevation level and on the slope of the terrain, and were oriented towards the scenery (Figure 6). None of the units blocked the scenery view and the sun light received by the other. The extent of levelling that was made on the terrain was minimal. In the Bağin thermal facility, the cafeteria and restaurant unit was positioned in the lowest elevation level, right next to the Peri stream (Figure 7). The cure units were designed in the upper level, in parallel with the natural flow of the spring water. The accommodation areas, as in the other facilities, were designed in the uppermost elevation level, with a simple plan type, in small scale, and as compact (Figure 8). In case one wants to benefit from the wind an inclined terrain, the building should be positioned at a high level; on the other hand, in case one wants to protect from the wind, the building should be positioned on the bottom part of the slope. Therefore, in order to decrease the effect of the wind on the facilities present in the study area, they were positioned on the bottom of the terrain slope (Figure 9,10).
Orientation Selection	One of the criteria required for the effective utilization of the building area is the correct orientation. While the orientation of a building depends on various criteria including topography, climate data, scenery, and nearby areas; the two important factors that have to be considered in the orientation of a building based on an ecological approach are the sun and the wind. While the sun is used for natural illumination and warming, the wind is used for cooling and ventilation [5]. The suns direction was taken into account in the positioning of the facilities present in the study area. In terms of energy effective approach, flexible and adaptable solutions were developed for protection/utilization of the sun and the wind during the summer/winter seasons. It can be seen that the building facades were oriented towards south and southeast, which are the most suitable directions. The accommodation and social units in the Kos and Golan thermal springs can benefit from sun light during the day. In the Bağin thermal spring, the space organization and the windows were designed to utilize the sun light.

Figure8. The Bagin thermal facility settlement

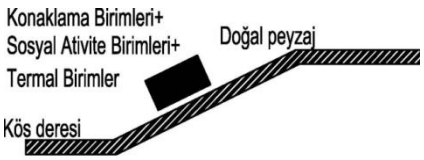


Figure 9. Bin-Kap facility terrain settlement plan

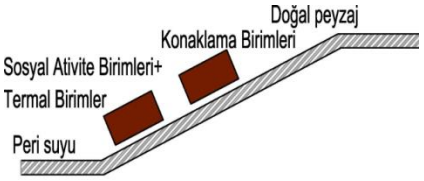


Figure 10. Golan and Bağin facilities terrain settlement plan

Figure 1. Bin-Kap thermal facility accommodation unit

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

Green Texture and Landscape Design	Another factor that provides the effective utilization of the building area is the landscape design. In addition, increasing green areas and protecting the available green areas are ecological design requirements [6]. During the construction process, the surrounding terrains and the water stream were protected from damage. The Golan and Bağin Thermal Springs were designed next to the Peri stream, among natural beauties including 400 mountain goats, as a peaceful area with amazing scenery. In order to increase and improve the biodiversity in the study area, more than 50% of the terrain was used as an open landscape area. In addition, the plants that were used in the landscape were selected especially as plants that are resistant to cold climate. The natural vegetation species present in the region are green in summer and defoliate in winter. Plants that are used in this manner protect the building envelope from solar rays during summer, while allow these to enter the building during winter.
Climate Data	Considering the fact that more than half of the energy consumed in the world is consumed in buildings, designs that are made based on an approach that handles climatic conditions and environmental data as design data is an important step towards solving the current energy problem [7]. The study area is mainly located in the cold climate region. The summers are hot and dry while the winters are cold and harsh. When the plan schemes of the facility units in the study area are observed, it can be seen that square and rectangular plan types were preferred. In all the three facilities, the units were constructed with minimal wall area in order to reduce heat loss. Excessive indentations, wide bow windows, and eaves were avoided in the accommodation units, cafeteria and restaurant units in order to prevent the formation of shady areas. It can be claimed that the facility utilizes natural resources properly; the preferred stone, wood, and brick as construction materials protects the building from energy loss in cold weather and from energy outflow in hot weather (Figure 11). Since the facilities are located in a cold climate region, the design was prepared to include concepts such as maximum utilization of the warming effect of the sun during the coldest seasonal period, protection from wind, and

Figure 2. Golan facilities surroundings

Figure 3. Bin-Kap thermal facilities hot water pools

Figure 4. Bin-Kap thermal facility accommodation unit

Figure 5. The interior view of the cafeteria (Bin-Kap)

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

	containment of heat within the building.	 **Figure 6.** Stone utilization in the Bin-Kap cure unit exterior
Building Design	The facilities that were analyzed in the study area had some differences in terms of their architecture. However the architecture of all the three facilities had a relaxing atmosphere which was in harmony with the natural texture. The facilities were designed to respect the environmental boundaries (Figure 12). Natural materials were selected in the construction of the units. Mainly natural stone, wooden, and brick materials were used. The cure units were designed based on the direction of the water flow. In the cure units of the Kös thermal spring, a windbreaker area is followed by a dressing area. After this, the section with the hot water pools is reached and here the pools can be accessed (Figure 13). Next to the larger pool, there are three hammam (Turkish bath) niches. The men's and women's cure unit plans develop symmetrically. While the massage process is applied in the space called hammam niche in the women's unit, in the men's unit a massage saloon and a cafeteria for resting are constructed additionally. A tepidarium-like temperature transition area was added later to both sections. In this section, the temperature of the hot water decreases slightly and these sections are used as resting areas. Thanks to their functions, the cure areas are modest and enclosed with blind stones (Figure 14). Steam control is provided through the small natural ventilation slits in the overhead illumination walls. The plan of the Golan and Bağin thermal facility cure units is smaller scale compared to that of the Kös thermal facility. However, there are windows on the walls in the cure unit spaces of Golan and Bağin facilities. With these windows, both natural illumination as well as control of steam and gas which are released from the thermal pools is provided. In addition to the natural illumination, there are also niches in the upper and lower parts of the walls.	

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

Although users report that they are satisfied with the ventilation in the pools, it was observed that the natural ventilation is not sufficient in this space and the steam of the thermal pool condenses on the ceiling and falls on the flour in the form of water droplets. Humid spaces with insufficient ventilation lead to bacterial growth. This poses health risks. In all the three thermal springs, the cure unit plans were designed as rectangular and square in shape. The slope of the roof was not sufficient. The steam which condenses on the ceiling falls over pool users in the form of water droplets. In order to remedy this situation, the slope of the roofs has to be increased and the evaporated water has to be collected and discharged. Because of the high humidity in closed wet areas, designs with roof skylights have to be made for the cure units with the thermal pools. The roofs, vaults, and domes have to be designed with a slope that will allow the easy removal of humidity and a good ventilation system has to be installed. In addition, the materials and equipment that will be used in these spaces have to be resistant to wet volumes. In order to provide hygiene in wet volumes, it is necessary to use bright surfaces, empty walls, hidden illumination systems, and wooden and natural stone materials that are resistant to water and humidity. It should be ensured that the showers and the foot disinfection channels are utilized by users before they enter the pools. To fill up the pools, a filling and flooding system that prevents the formation of stagnant regions in the pools should be used. When the thermal facilities in the study area are observed, it can be seen that the water flows naturally to the facility. In the pools, there are water flooding and discharging systems. When the thermal cure structure in the Bin-Kap facilities of the Kös thermal spring are observed, it can be seen that the structure consists of a steam room and a general pool - the basic units of a thermal spring, that are built in the incoming direction of the thermal hot water and of hammam niches designed around the pool. The first space where intense steam forms is the sauna. This space is designed in the entrance point of the hot water and is prepared in square shape. When designing the sauna the most important factors that need to be determined are the temperature and the number of people who will use

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

the room. After the capacity is determined, it is important to arrange the sitting areas for the most appropriate utilization of the area. The sauna tradition requires the use of wood as a surface coating material. Wood retains the heat; it is not a conductive material as metals. The sauna has to be well insulated. In this way both heat loss is prevented and the rapid heating of the rooms is achieved, providing energy and time saving. In addition, the ventilation grills have to be positioned so that they can provide air flow but do not influence the temperature. The windows in the restaurant and cafeterias of the thermal facilities in the study area were designed to be large in order to benefit from the natural light and the scenery can be observed from the interior (Figure 15). In the green area surrounding the facility all plants are natural. Accommodation buildings are as important as the bath buildings in a thermal spring settlement, because in order for the hot water to be effective on human health, it has to be used regularly at least two times per day for 21 days [8]. The facility accommodation units in the study area are designed as simple, small scale, compact and in square and rectangular shapes. The interior space was tried to be used effectively and unnecessary areas were avoided. In the accommodation units of the Bin-Kap facilities, wood and stone were used as materials, while in the Golan and Bağin facility cure units, stone and bricks were used. The interior illumination is sufficient and the necessary comfort conditions were tried to be provided. The region where the facilities are located has a cold climate. Since access from the accommodation units to cure units is provided through open walkways, some problems are encountered in the utilization of the facilities during winter. Since completely closed passages such as closed tunnels etc. between the accommodation unit and the thermal center are not possible and when there is only one the thermal center, passages that are protected from the rain and wind and the access of facilities by the elder and handicapped individuals from distant accommodation units should be considered.

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

Conservation of Materials	Considering the relationship between ecology and materials, wood is one of the main materials that are perfectly compatible with ecological design criteria. Wood is the only building material that can renew itself. Trees can be cut and grown and are thus the only source that can continuously provide building materials. In addition, wood is the only material that can clean the air [9]. Wood was used as material in one section of the Bin-Kap thermal facility accommodation units, cafeteria, and cure units. It is very important that the materials used in ecological building construction are local with regard to supplying these. The delivery of any material, which is not produced in the region or not easily found as a raw material, to the construction area will lead to additional energy loss. The structure of the facility and the used materials were determined though inspections in the area and interviews with the facility owners. Using natural and local materials (stone, soil, and brick) and preferring a form that is appropriate for the natural environment in the architecture fits the concept of ecological design. The stones in the nearby Kös stream were used during the construction of Bin-Kap thermal facility cure units in the Kös thermal spring. The used stone material makes the building harmonious with the surrounding nature (Figure 16). There are open and closed pools in the cure units of Golan and Bağin thermal springs. Both units were constructed completely with local stones. In the thermal spring facilities built in the study area generally local and natural materials were used. It can be seen that the facilities which are based on the ecological building concept are harmonious with the environment thanks to their unique materials and philosophy. In Bağin and Golan facilities, the heating system which uses biomass helps to protect the agriculture and the surrounding woodlands; Dry oak branches are used as the energy source. Most of the services provided to customers in the thermal facilities of the study area are obtained from local and organic products. Selling local handcrafts can also economically aid the local community.
Water Conservation	For landscape irrigation, water is brought from the Kös stream in the Bin-Kap thermal facility of Kös thermal springs. Instead of this method, landscape irrigation using

Research Article
Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

	rain water collection channels can be more effective with respect to protecting the level of groundwater. When the roofs of Golan and Bağin thermal facility accommodation units were observed, it was seen that rain water collection channels were available. As a result of inspections, it was identified that this system was very simple and was constructed with primitive methods; the size of the tubes was not sufficient in some locations and these did not provide a solution for the storage of rain water. The rain water which is collected from the roof surface has to pass through filters in the gutters and then has to be collected and stored in the rain water reservoir. It can be seen that utilizing the solar cells in the roofs of all three of Kös, Bağin, and Golan thermal facilities, the energy necessary for the hot water used in their accommodation units is obtained. Biological therapies are carried out in the facilities utilizing the pure hot water resources and without any additional chemical based therapies. The utilization system of the thermal waters was planned to protect the natural water conditions are protected. However, the discharged water is sent to cesspools through tubes. Constructing a system that will provide the recycling of the utilized thermal waters is essential for the ecological sustainability of the facilities. The installation of a system that will provide the recycling of the discharged water and a waste disposal system that will provide the recycling of solid organic wastes will ensure that the facilities acquire a complete eco-identity. Informing customers about water and electricity use and placing the necessary warnings in a written form at specific locations in the facility will ensure water and energy saving and will increase the efficiency.
Environmental Pollution Control and Waste Management	In the inspections that were carried out in the facilities, it was observed that there were serious deficiencies in terms of environmental pollution and waste management in these. In the process of architectural design, for the realization of waste management; the designer should consider preferring recyclable and reusable materials, collecting and storing wastes at specified points, and utilizing the stored wastes for the building's needs such as the heating systems in order to obtain outcomes in terms of ecological architecture

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

	design criterial. In addition, during the observations, it was determined that vehicles could access all the units in all three facilities. This results in increased CO_2 emissions. During facility design, while preparing the layout plan, vehicles and similar pollution sources should be kept out of the facility whenever possible; however, when this is planned, the access of handicapped individuals should be also considered.	
Protecting the Ecosystem	In general terms, awareness on ecosystem and cultural asset protection has not been created in the facilities. In thermal facility designing, emphasis should be placed on designs that do not harm the natural environment. The designs should be prevented from being a power that eradicates wildlife and should be made harmonious with the environment. It is possible to use design as a power which protects the nature, by complying with standards that will be developed for this purpose. Facilities have to take measures and carry out studies to prevent the environmental pollution which destroys the ecosystem. The diversity of the surrounding flora and fauna should be protected.	
Comfort Conditions	Bad weather conditions, toxic substances, the absence of sunlight or extreme noise have permanent health effects. Besides creating environmental problems, polluted indoor air also has a direct effect on health [10]. For the creation of healthy indoor environments the objectives should include: protection against outdoor air pollutants, control of pollutant formation within the building, protection against radioactive emissions, utilization of building materials that do not contain toxins, designing the building so that it can receive adequate amount of sunlight, and considering the principles of protection against excess noise in the designs [11]. It was observed that the comfort conditions were generally met in the facilities.	

CONCLUSION

Based on the ecological criteria analysis of Golan, Bağin, and Kös Thermal Springs, which are situated in the Eastern Anatolia Region of Turkey and have unexplored resources, the following results were obtained in summary: The facilities in the region utilize the simplest form of ecological design criteria. The designs were shaped based on the physical and socio-cultural structure of the region's environment. The construction system of the facilities is directly related to the geographical conditions; the buildings were mainly constructed with stone, wood, and brick materials. The used materials are specific to the region and can be easily acquired.

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

The utilization of these materials has contributed to the protection of natural resources. In the selection of the settlement location, the topography, terrain orientation, and natural landscape and climate data were used in accordance with ecological architecture criteria. Topographical characteristics were protected by minimal levelling on the terrain and the ecosystem was not harmed. The facility units were designed as simple scale, small, and compact, while square and rectangular plan types were preferred. With this type of planning, the sun was utilized in the best possible way and the conservation of raw materials and energy was provided. Deficiencies were determined in the facilities including the absence of rain water collection systems, thermal water recycling, and waste water treatment. Overcoming these will contribute in water conservation. Bringing the thermal waters to the facilities utilizing their natural flow and the natural slope of the terrain is a positive approach in terms of resource, energy and material conservation and the protection of the ecosystem. These facilities, which do not make use technology to a great extent, can become completely ecologically successful, by achieving a skillful balance between traditional and modern methods. According to the presented information and assessments, the first necessity for the design of ecological thermal tourism facilities is carrying out alternative studies on the status of the thermal springs in Turkey and the use of thermal waters; implementing development plans that are based on a principle of protection that will not alter the ecological structure of the spring and will not lead to deterioration in the physical and chemical properties of the water, and finally issuing the necessary legislative regulations. Regulations on thermal tourism have to be revised and the ecological criteria that thermal facilities should acquire must be specified in the regulations. For the protection and the recycling of the thermal water, concerned disciplines should work hand in hand to produce projects. A regional and balanced form of tourism will be achieved if these facilities take advantage of the region's alternative tourism types, which the facilities can easily integrate with. The attention of investors should be drawn to regions which have a high thermal touristic potential, but are not explored yet. Before doing this, the infrastructure of these regions should be prepared. In the designing of a thermal facility, priority and prominence should be given to the cure center. The architecture of the cure center should be designed according to the thermal water axis. The physical and chemical properties of the water in the thermal spring where the facility will be established should be determined. The development of the cure units should be based on these properties. In the designing of an ecological thermal facility, environmental planning is as important as the planning of the cure units. It should be confirmed that there is no air pollution in the nearby areas of the thermal spring, that the climate conditions are favorable, and that the cure season is sufficient. The natural environment where the units are located has to be protected during the design. The areas where thermal facilities will be built have to be designed according to the region's settlement characteristics, terrain data, and the climate conditions. The traditional structure of the area should be sustained along with the geographical features. The basic purpose should be protecting the nature of the environment, while interpreting the nature with a novel architectural approach. Local materials should be mainly utilized in the facility structure. Utilizing sun energy, geothermal energy, and biomass energy as renewable energy sources, providing the recycling of the hot waters used in the pools and the other cold water wastes, utilizing waste wooden materials as fuel will help to minimize emissions and environmental pollution and to provide a higher quality of living. In addition, in order to protect the ecological balance, training activities for young and adult guests should be provided through the collaborative efforts of other tourism actors and local organizations. Tours to historical, social, and cultural places in the city should be organized so that users can use their off-cure times effectively. Walking trails and recreation areas have to be planned in the thermal facility area. The current vegetation in the design area should be protected as much as possible. Deterioration of the natural balance will lead to soil loss, climate changes, and the loss of plant-animal species. The designs should be

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

prevented from being a power that eradicates wildlife and should be made harmonious with the environment. During facility design, while preparing the layout plan, vehicles and similar pollution sources should be kept out of the facility whenever possible; however, when this is planned, the access of handicapped individuals should be also considered.

REFERENCES

[1]. Kısa Ovalı P. Kitle Turizmi ve Ekolojik Turizmin Kavram, Mimari ve Çevresel Etkileri Bakımından Karşılaştırılması, YTÜ Arch. Fac. E-Journal, 2008,24: 64-79.

[2]. Weihong L. Sustainable Design for Low Carbon Architecture, Procedia Environmental Sciences, 2011, 5: 173-177.

[3]. Abdelwahap Z. Renewable Energy, Sustainable development and Environmental Protection in Ksours (Case of Algeria), Energy Procedia, 2012, 18 : 666-671.

[4]. Yazman D (2011) Mimarlığın Topografya ile Diyaloğu . Arkitera,2011, 9:312.

[5]. Serin E. Ekolojik Konut Tasarımı Kriterlerinin Araştırılması ve İzmir İli İçin Bir Tasarım Modeli Önerisi. Master's Thesis, Dokuz Eylül University Institute of Natural Sciences, İzmir, 2011.

[6]. Serin E. Ekolojik Konut Tasarımı Kriterlerinin Araştırılması ve İzmir İli İçin Bir Tasarım Modeli Önerisi. Master's Thesis, Dokuz Eylül University Institute of Natural Sciences, İzmir, 2011.

[7]. Tercan A., Dengiz N. Mimari Tasarım Sürecinde Tasarım-Teknoloji İlişkisi ve Enerji Sorunu. Tasarım Sorunları Ders Notları. Mimar Sinan University Department of Architecture Publication, İstanbul,1998.

[8]. Karagülle Z, Doğan M. Kaplıca Tıbbı ve Türkiye Kaplıca Rehberi, Nobel Tıp Kitapevi, İstanbul,2002.

[9]. Berber F. Ekolojik Malzemenin Tasarmdaki Yeri ve Ekolojik Malzemeyle Mimari Konut Tasarımı. Master's Thesis, Haliç University of Natural Sciences, İstanbul, 2012.

[10]. Levins H. Best Sustainable Indoor Air Quality Practices in Commercial Buildings in Environmental Building News. Received from Green Building, www.ebuild.com website, 06.11.2015.

[11]. Çalışkan Ö. Bursa İçin Öncelikli Yapılaşma Kriterlerinin Araştırılması ve Bununla İlgili Örnek Bir Yapı Tasarımı. Master's Thesis, Gebze Technical University Institute of Natural Sciences, Gebze, 2007.